

Tipularia

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Mozelle Funderburk

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Front Cover The fringed gentian, *Gentiana crinita*, is "certainly one of our most beautiful wild flowers," says the New York Botanical Garden's "Wild Flowers of the United States: the Southeastern States." The stem is 4-40 inches tall; the corolla, often 2 inches long, is at first furled, then flares to display the fringe. Turn to page 18.

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The busy honeybee: Stabilizer for shifting sands?

A new study may show a way to increase soil-binding plants on barrier islands and the mainland coast

By Moonyean S. (“Tee”) Brower

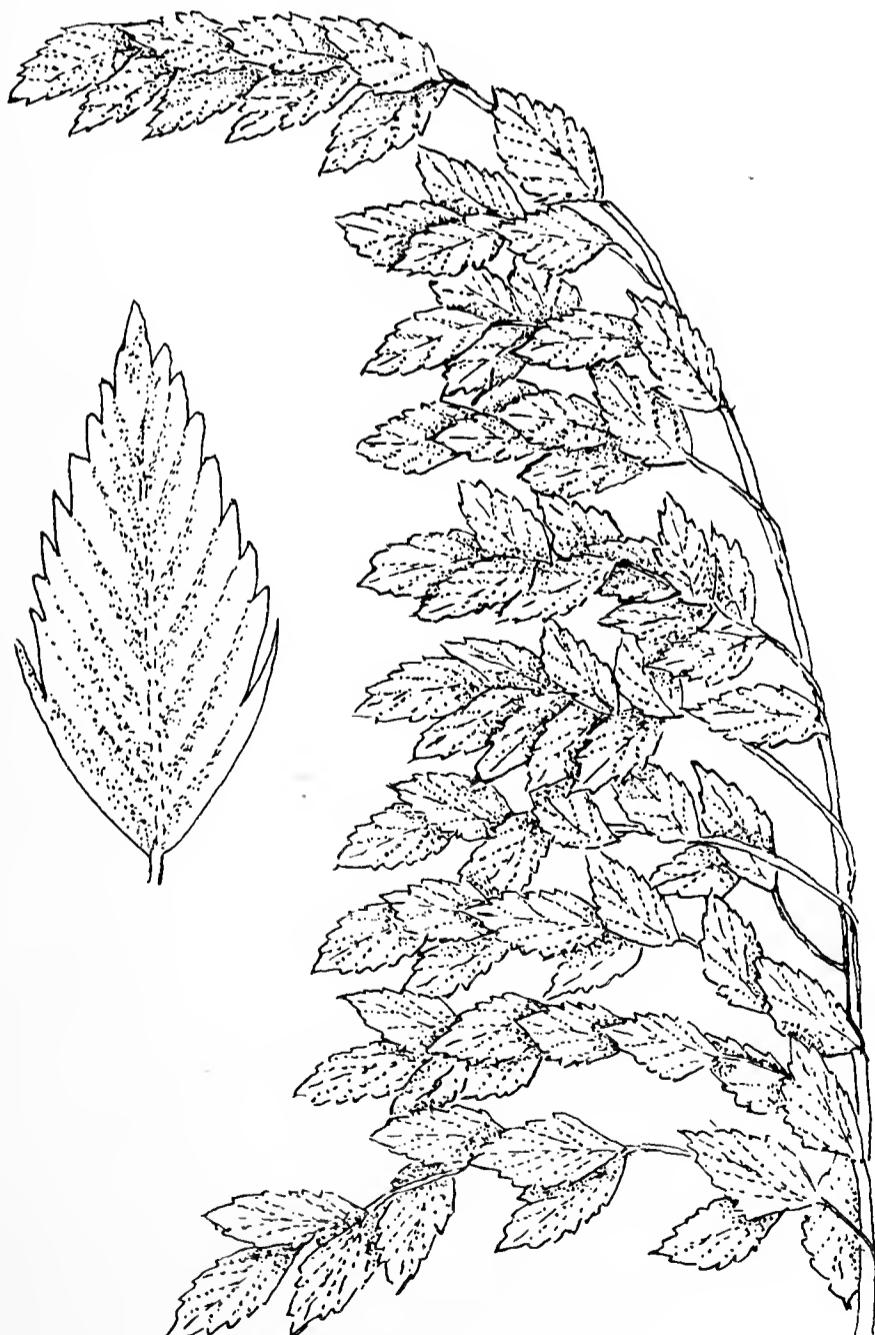
Illustrated by Margery Borom

The honeybee, *Apis mellifera*, is a relative latecomer to North America. Early settlers from Europe brought it along to provide a source of sweetener. It did, one might say, a honey of a job.

Here the bees had access to a flora of far greater diversity than in Europe. Settlers added to the native abundance

by bringing and sowing seeds of medicinal herbs and edible wild greens, which soon flourished. Bee colonies thrived, and honey flowed in the New World.

Feral bees have established few colonies on the coastal islands and the adjacent mainland of Georgia, and few



Uniola paniculata, sea oats, is considered so important in preserving beaches and dunes that it is protected by a special Georgia law. It's against that law to gather sea oats.

beekeepers have placed hives there to take advantage of the abundant sources of pollen and nectar available.

For this study, hives were located in the Savannah area on Skidaway and Sapelo Islands and at three mainland sites along the Inland Waterway.

The study has attempted to (1) identify the plants visited by bees, (2) establish the seasonal pattern of pollen collection on the islands and the adjacent mainland, and (3) determine whether the presence of bee colonies leads to increases in seed set and in the number of new individuals among dune and beach stabilizer plants.

The third objective holds special significance for the barrier islands and the mainland coastline, and the results were not disappointing in that respect.

Briefly put, the conclusion was that the bees' foraging activities might help to increase the population of soil-binding plants important to curbing erosion of the fragile dunes and the beaches. (Other findings will be discussed later.)

Bees collect pollen in special baskets called corbicula, located on their metathoracic (hindmost) legs. Packing pollen into these baskets results in a compact pellet that may be easily removed by a pollen trap located in the hive where bees must pass as they return from a foraging trip.

For two years (1980 and 1981) pollen was trapped this way in the hives placed on Skidaway, Sapelo, and the mainland. Pellets caught in the traps were weighed upon retrieval and frozen to await analysis.

Different species of pollen exhibit different colors, textures, and morphology (form and structure), allowing them to be sorted into groups readily under a dissecting microscope. A sample was removed from each group of pellets and prepared for microscopic examination.

Contrary to expectations, not all pellets were "pure." Pellet content varied from one species to as many as six different species. Thus weight of

"color" groups was not valid for use in quantitative comparison.

Thereafter an alternate weighing approach was employed. It was based on the percentage of each species contained in the average multispecies pellet in each collection.

Pollen was tentatively identified by using several pollen keys. Identification was confirmed by reference slides made from pollen of plants blooming near the bee yards throughout the season and from herbarium specimens at Armstrong State College in Savannah.

Pollen sources were classified by habit as trees, shrubs, woody vines, or herbaceous species.

Eventually it was determined that the honeybees collected substantial amounts of pollen from 42 species of plants on Sapelo, 53 on the mainland, and 77 on Skidaway.

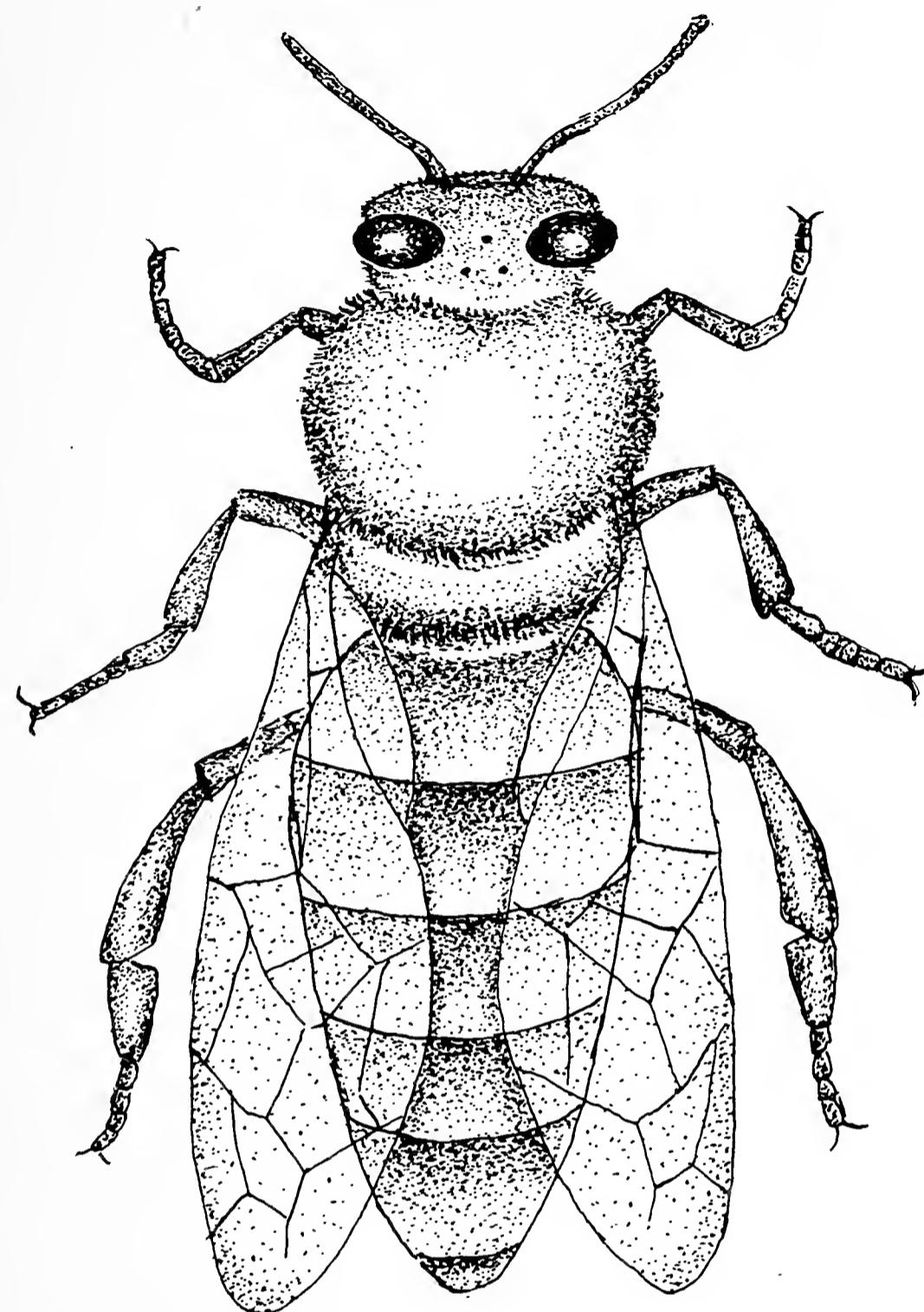
Numerous other species turned up as trace amounts in the collection. Except on Sapelo, bees found some plants from which to collect pollen or fern spores during every week of the year.

The bees collected from a different number of species in each of the foraging territories largely because there is a different number in each. On Skidaway, development and cultivation have taken place within range of the bee yard and many exotic ornamentals have been introduced in landscaping an extensive subdivision and an adjoining golf course.

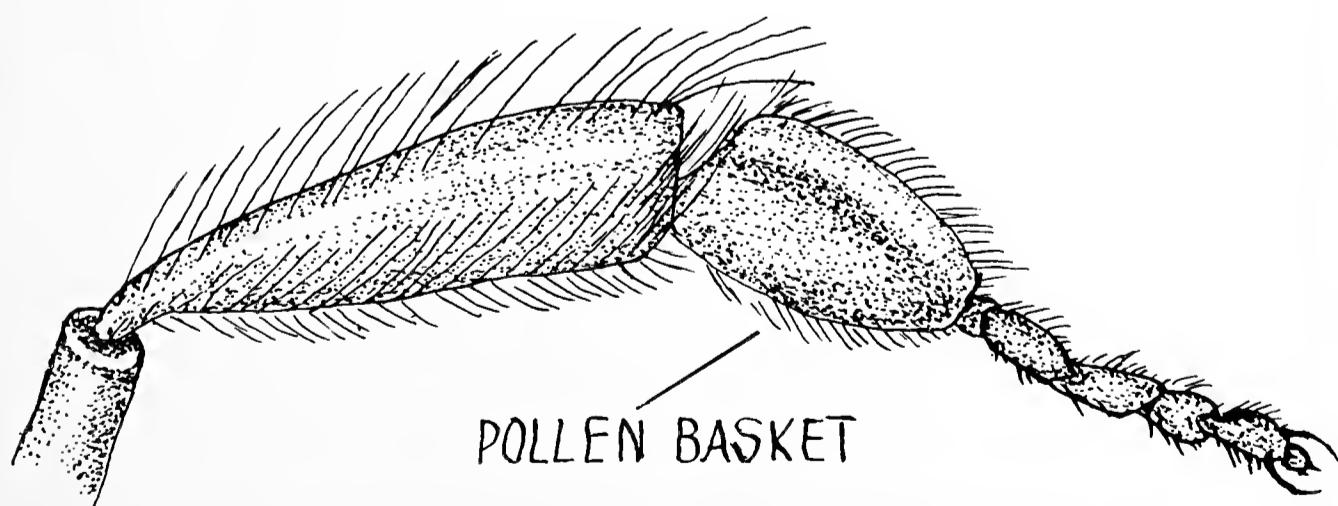
During the early part of the year, bees collected large amounts of pollen from trees. *Pinus elliottii* (slash pine), *Acer rubrum* (red maple), *Quercus* species (oaks), *Carya* species (hickories), and *Salix nigra* (black willow) were dominant.

Although several other trees such as sassafras and witch hazel were in flower and shedding pollen during the same period, their pollen appeared only as traces or was absent from the collections.

Perhaps one of the most notable findings was that during one week in



MARGERY BOROM



The honeybee, Apis mellifera, plays a give-and-take game with flowers. Pollen is collected, stowed, and transported in so-called baskets located on the rear legs of the bee.

January, bees found spores of *Osmunda cinnamomea*, the cinnamon fern, and collected them along with small numbers of other unidentified spores.

Winter annuals also contributed pollen during this early period, ranging from 10 percent to 40 percent of the total. By late February and early March, an agricultural grass and several species of *Rumex* (docks), *Rubus* (blackberries, dewberries), and *Trifolium* (clovers) were available, and the bees took advantage of these pollen sources.

Yellow jessamine, *Gelsemium sempervirens*, a native woody vine widely distributed on roadsides and in cultivated areas, also contributed pollen to the collections.

In April, shrubs such as *Ilex vomitoria* (yaupon holly), *Myrica cerifera* (wax myrtle), and *Sambucus canadensis* (elderberry) became important components of the collection for a two-week period, accounting for 70 percent of the total.

Although some species of oaks and pines were still shedding substantial amounts of pollen, the bees seemed to prefer the shrubs. When shrub pollen began to dwindle, collection of tree pollen reached a second peak.

Near the end of April, a wide variety of herbaceous species became abundant and accounted for 78 percent of the bees' collection.

Among these, the most heavily visited were grasses such as *Panicum* (panic grass), *Arundinaria gigantea* (cane), and *Festuca* (fescue) and composites like *Erigeron philadelphicus* (daisy fleabane), *Erigeron vernus* (another of the fleabanes), *Senecio* species, and *Gaillardia pulchella*.

They were followed in quantity by a complex of legumes: clover, sweet clover, alfalfa, and a mint, *Stachys floridana* (wild artichoke or hedge nettle).

Through most of May, herbaceous species accounted for 99 percent of the collections. There was a short resur-



Marsh grass
(*Spartina*)

gence of shrubs in late May, when cultivated privet, wild olive, American holly, Dahoon holly, and gallberry were flowering.

From June to the end of the year, nearly all plants visited were herbaceous. Grasses, composites, and legumes, in that order, again were the most heavily visited.

The fall period was dominated by a great abundance of grasses and composites. The grasses included panic grass, marsh grass (*Spartina*), crab grass (*Digitaria*), salt grass (*Distichlis*), and fescue, as well as sea oats (*Uniola paniculata*).

Composites visited in the fall were ragweed (*Ambrosia artemisiifolia*) and several species of goldenrod (*Solidago*), blazing star (*Liatris*), throughwort (*Eupatorium*), marsh fleabane (*Pluchea*), and groundsel tree (*Baccharis*).

There were other sources of pollen used by the bees at various times. Woody vines such as the grapes (*Vitis*) and their relative, *Ampelopsis arborea*,

the peppervine, made up about 4 percent of the collection during their periods of anthesis (full flower). When palms and palmettos flowered in mid-summer, the bees turned to them for several weeks. The small shrub *Itea virginica* (Virginia willow) provided pollen for a short period, as did *Aralia spinosa* (Hercules club).

The circadian timing of pollen shed probably influences what the bees collect, especially during early morning and evening when on-shore breezes are gently rising and falling. These are the times of day when foraging is most active during the hot part of summer and fall.

Previously several authors, including R. J. Adams and M. V. Smith in 1977 and Adams, C. Manville, and J. H. McAndrews in 1978, had reported that bees collect wild grass pollen, but only as minor components of their total harvest. In 1981, D. W. Severson and J. E. Parry reported that bees neglected red clover (*Trifolium pratense*) and collected the pollen of corn (*Zea mays*) in preference.

The present study has resulted in somewhat different findings. Bees not only visit many of the anemophilous grasses (those pollinated by wind-borne pollen) when they are in full flower, but also often seem to prefer them to other accessible sources.

For example, on Sapelo Island, where sea oats are prevalent on the front dunes near the hives, bees utilized this grass for 11 percent of their total annual pollen collection.

For barrier islands where erosion brought about by human activities is a problem, it could be significant that bees collect large amounts of pollen from various plants with extensive rhizome and root systems—plants like grasses, composites, and others. Such plants serve as soil-binders.

According to unpublished data from annual plant surveys, there are indications that, in areas foraged by bees, increases occur in the number of in-

dividuals or colonies of at least some of the important dune stabilizers.

Since foraging bees bring about cross-pollination and subsequent production of hybrid seeds in insect-pollinated species, it seems possible that the same may occur in monoecious anemophilous species (wind-pollinated species with male and female flowers on the same plant).

An increase in the seed set of sea oats as a result of the presence of foraging bees was reported by A. Dietz in 1982. With a better quality and a higher yield of seeds, the number of stabilizer species in high erosion areas might show an increase.

That is how establishing bee colonies to increase foraging in such areas might contribute to the fight against erosion. The dunes and the beaches can certainly use the help.

Another application of the conclusions suggested by this study relates to the growing market for pollen sold for human consumption.

Not all pollen is safe for such use. A potential exists for allergic or toxic reaction to the pollen of some species.

When intended for sale for human consumption, pollen should be fully and accurately identified on the package label as to the various species present.

ACKNOWLEDGMENTS

This work was part of a study carried out by A. Dietz of the University of Georgia, Athens, and was funded by National Oceanic and Atmospheric Administration Office of Sea Grants, Department of Commerce, under grant #NA 80 AA-D-0091 (Proj. #R/G-1).

Thanks to Rainer Krell and his crew members who collected pollen from the traps and provided the samples for identification.

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Neither age nor anything else impeded the peregrinations of this most tireless of Southern-bred botanists

Roland M. Harper: truly a man for all seasons

By Marie B. Mellinger

Conventional botany books usually begin with the ferns and end with the composites. Roland M. Harper said, "Let the last be first," and began with the composites. Following his philosophy, I will begin with my meeting with Dr. Harper in Savannah in 1961.

He was 83 years young, handsome, dapper, and spry. At a dinner party at the home of Clermont Lee, a landscape architect in Savannah, he was witty and articulate, and very opinionated—always the privilege, it seems, of a botanical genius.

Harper reminisced about the days in 1901 and 1902 when he botanized across south Georgia. With his photographic memory, he recalled where individual plants had been found.

Clermont asked Harper if he knew Dr. J. K. Small, famous botanist of the South and author of "Manual of the Southeastern Flora" (1933). Harper's face lit up, his bright eyes twinkled, and, as he talked, a lifelike portrait emerged of Small as a man who played the flute, a man with a great love of the land, a conservationist before his time, and, although color-blind, an unsurpassed botanist in the field.

Next day we went on a field trip with Harper to the sand hills south of Savannah. Every plant and tree seemed familiar to him, and it was an adventure

to try to keep up with him as he almost ran from one old haunt to another. We all became convinced that we had met a living legend and an incomparable field botanist and ecologist.

Later, I had several letters from him. He was interested in the reproduction of the American lotus, *Nelumbo lutea*, and wrote extensively on various aspects of the plant.

Roland McMillan Harper was born in Farmington, Maine, August 11, 1878. His father was a learned scholar and teacher and his mother an author. In 1887, the family moved to Dalton, Georgia. Later it moved to Americus.

Harper enrolled in the University of Georgia in 1894 to study civil engineering and took a botany course only because it was required of all students. "The prescribed textbook was Gray's *School and Field Botany*, 1881? ed. (I still have it)," he wrote 60-odd years later.

"When I discovered that we could take the definitions already learned, and the descriptive manual, and identify almost any plant we came across, I was thrilled," he wrote. "I began scouring the neighboring yards, fields, woods, etc., to see how many species I could 'analyze' or identify, and by June (1895) I had broken all local records with a list of about 140 species.

"In the summer I scoured the country



Harper as a dapper young man (above) and as an elderly, but still energetic 83-year-old who seems not to be concerned about how he looks.

The map on the wall in the upper photo was published by the Central of Georgia Railroad, a favorite way for Harper to get around as he botanized in the South.



around Americus, my home, where the flora was very different, and I increased my list considerably."

After graduation, Harper did botanical work for the National Herbarium, the U.S. Department of Agriculture, the American Museum of Natural History, and the New York Botanical Garden, all the while working for his doctorate at Columbia University. He met Dr. Small, who was to become an influence in his life, at the New York Botanical Garden.

Harper attended his first meeting of the Torrey Botanical Club in October 1899, and wrote of it:

"(It) was held in the library of the College of Pharmacy on 68th St. There was a great contrast, both in members and surroundings, between this meeting and the meeting of the New England Botany Club, which I attended in June. The Torrey Club met in a room with bare floors and low ceiling, and not very well lighted. No liveried attendants were there to respond to a press of the button, or take care of the hats and coats, and no refreshments were served.

"The members do not smoke, perhaps on account of the presence of ladies, who were, and still are, I believe, barred from membership in the New England Botany Club. Among [those] present were Dr. (N.L.) Britton and Mrs. Britton (who, by the way, was the first female botanist I ever saw)."

Harper returned to Georgia on vacation in the summer of 1900, and in July was joined by Percy Wilson, a protege of Britton's at the New York Botanical Garden. They visited Stone Mountain, Kennesaw Mountain, and Pigeon Mountain, among other places.

The next year, 1901, Harper published a monograph, "On a Collection of Plants Made in Georgia in the Summer of 1900," a fascinating account of botanizing in some 12 counties. Through his many years of botanizing in Georgia, he was responsible for many new records and added localities for many species. He began keeping a

Harper in action: a Savannah visit at the age of 83

Excerpts from notes by Clermont Lee on the 1961 visit to Savannah of Roland M. Harper and his brother, Francis:

Saturday, September 2. Lotts Creek-DeLoach expedition (near Statesboro) with Herman N. Coolidge, Ivan R. Tomkins, Roland Harper, and Clermont Lee. Roland said he couldn't identify plants from a fast car as well as from a slow train. He has a photographic mind and a Lord Macaulay memory fortified by diaries he has kept for over 40 years. He can visualize where he is in relation to railway tracks, rivers, and towns.

In 1901-1902 when in this area, he would send his pack by train to the next station ahead and would cover the ground along the track by foot, writing down what he saw and adding plants to his portfolio. He would cover 20 miles in a day, sometimes.

Food was secondary and still is, at the age of 83. While here, he insisted on eating a five-day-old cheese sandwich brought from Tuscaloosa rather than our fresh lunch. He looks frail, but has more initiative and endurance on one sandwich and two glasses of milk than any of us on a large lunch.

Stop 1. Bog meadow on U.S. 80 approach to Jencks bridge. Roland became very interested in the plants, including grasses and sedges. We couldn't understand most of what he said because he speaks low and fast.

We walked away from the road and col-

detailed botanical diary in 1900.

In June 1901, Harper discovered a colony of *Elliottia racemosa* near Blox, Georgia, and communicated his find to Small. Until Small died in 1936, they carried on an erratic, sometimes voluminous, often coniferous (prickly) correspondence. Although the best of friends, they disagreed on almost every facet of botany. Small was a "splitter," Harper a "lumper."

On this subject, Harper wrote:

lected *Diodia harperi* (?). I asked Dr. Harper to let me know if he saw *Bartonia*. Fifteen minutes later: "There's *Bartonia*." His eyesight with Woolworth glasses (on the very tip of his nose) is superb. He spotted *Lobelia boykinii* and identified *Burmannia biflora* for me.

Dr. Harper was going to send some specimens off to be identified. "Sometimes the more duplicates you send, the more identifications you get."

Stop 2. We picked up Dr. DeLoach and parked at the bog meadow on the Portal road. Here Herman and I found, but couldn't reach, *Baldwinia atropurpurea* Harper, and Roland overlooked it.

Stop 3. Upper Lotts Creek *Elliottia* colony. It seems this station of plants has moved west from where it was first discovered. Old station was probably under new highway. Pictures taken of Roland at the station he and Hendricks found in 1901.

Stop 4. Residence of Elder J. Walter Hendricks, Metter, Georgia. I had concluded that this gentleman was long dead. Roland persisted, and we found his wife. The Rev. was out, and is still preaching. Dr. Harper helped Dr. DeLoach up the stairs here.

Stop 5. We drop off Dr. DeLoach, who supplies us with boiled peanuts from his field.

Sunday, September 3. This was Dr. Francis Harper's day. He is doing research on John Eatton LeConte.

Monday, September 4. Two Harpers, Tomkins, Curtis Bell, and Lee. Roland Harper's day, looking for northern limit of *Cliftonia* and searching for Paramore Hill.

First stop. Just inside Screven, where we

"Some excellent students are most sensible to *similarities* among organisms and give to these *similarities* the highest rank of importance. These scientists tend to favor only a few large groups in the classificatory systems.

"Others, equally excellent students, are most sensitive to the *differences* among organisms, and assign to these differences the greater importance. Such workers tend to split large groups into more and smaller subgroups.

found *Cliftonia* on old road west of Newington. I think *Cliftonia* is an Altamaha Grit plant.

Second stop. Joseph C. Smith's property, near Newington. Francis had visited his 40-acre nonalluvial pond 20 years ago. (He brought his old marked topo maps.) We visited another smaller pond. Tomkins waded for *Glabraria*, which was growing with *Ilex myrtifolia*.

Lunch there at a very noisy, smelly pigpen. While we ate, Roland pressed some plants and went looking for more after finishing his light fare.

Third stop. Old Augusta road, Screven County, near Bucks Creek Church. We couldn't find *Cliftonia* where Bartram reported it. Francis Harper interrupts Tomkins to apologize for being a garrulous old man. Roland was always very quiet in the car, and was busy with county lines, railroad tracks, etc.

Fourth stop. Paramore Hill, southeast of Millen on Georgia 25. Bluff (on the Ogeechee River), facing south, is 270 feet above sea level and possibly 70 feet high. It is wooded and has a few pretty rocks on slope and in stream. Woods (contain) *Cercis*, *Halesia*, *Ilex vomitoria* (probably planted by Indians), etc.

Tuesday, September 5. Short trip to Tybee by Harpers and Tomkins.

Wednesday, September 6. Roland takes a bus for Waycross, then Thomasville to see friends. Francis takes bus to Chapel Hill. Everyone seems to have enjoyed the Harpers' expedition to Savannah. Francis (74) is very good company. Both men have a store of fascinating knowledge and are glad to get an audience and be appreciated.

"No one can say one point of view is right and the other wrong. Both are essential to a balanced and thorough understanding of nature in its infinite complexity."

Small once wrote of receiving "a long and interesting letter" from Harper, and added, "He is an excellent, destructive, and constructive critic."

In 1903 and 1904, Harper collected wood samples in Georgia to supplement those collected by Small for the Atlanta

Exposition in 1895. Harper was interested in trees and found the largest known specimens of *Rhus glabra* (sumac) and *Staphylea* (bladdernut) in Floyd County and *Aralia spinosa* (Hercules club) in Early County.

Harper came back to the South to live in 1905, going to Alabama to continue the work of Charles Theodore Mohr (1824-1901) on the economic botany of the state. In 1905 and 1906, Harper mapped the geology of Georgia. He spent some time in Florida and

South Georgia in 1900

This part of Georgia (from Waycross to Douglas) is a most excellent region for studying the distribution of plants, for the destructive influences of civilization have scarcely begun to make themselves felt here, and most of the species are fairly common throughout their respective areas, so that their ranges can be determined with some degree of accuracy. In the case of the more conspicuous plants one can observe many of them to good advantage while traveling by rail, as I found from experience. Coffee County seems never to have been visited by a botanist before.—*From Harper's "On a Collection of Plants Made in Georgia in the Summer of 1900."*

Alabama and returned to Georgia as research professor of economics at the University of Georgia in 1928 and 1929.

Harper never learned to drive a car. He would take a train out 10 miles or so from a station, and walk and botanize all the way back. He also listed plants he saw from train windows and published several monographs of what he called "car-window notes on vegetation." He also depended on friends for transportation. In 1943, at age 65, he married one of his drivers, Mary Sue Wigley of Dawson, Alabama.

Harper's journeys into every part of Georgia resulted in many articles and monographs between 1900 and 1953 about its flora and other aspects of its natural history. Among his best-known works are "Phytogeographical Explorations in the Coastal Plain of Georgia"

(1905) and "A Phytogeographical Sketch of the Altamaha Grit Region of the Coastal Plain of Georgia" (1906).

Through the years, he wrote about many Georgia topics: forest resources, geology, physiography, population trends, and uncounted numbers of plants. All this time he was writing prolifically about other states, mainly in the South, but Alabama was the only one that equalled or exceeded Georgia as a subject. His home was in Alabama for many years.

Harper did geological surveys of Georgia, Florida, and Alabama. He made detailed maps and wrote accounts of peat deposits and rock formations. He was in charge of the Florida state census in 1925, and many articles that he wrote were based on census findings there and elsewhere.

As time went by, his subjects were often far-out. In 1930, he did a statistical study of a cemetery, a routine enough subject, but in 1953, he wrote about communistic and vandalistic influences in cemeteries.

He wrote about race differences, socialistic and communistic economic systems, religion versus soil conservation, political parties, farm building, sex ratios, and a way to measure civilization. Once, for a Birmingham, Alabama, newspaper, he wrote about what is wrong with Georgia.

Dr. Harper died in 1966, four months shy of his 88th birthday. He was a great man and a great botanist who contributed much to the botany of Georgia. He was among the first to relate the plants to their environment and to consider the plant community as a whole, instead of the individual species. He was sometimes verbose, but never boring. As one colleague said, "If he ever got tired, he never mentioned it." He was truly a man for all seasons.

AUTHOR'S NOTE

I am indebted to Miss Clermont Lee and Tom Dodd for the opportunity to read most of Harper's writings. Some pertinent facts were gleaned from his obituary by Walter B. Jones in the Journal of Alabama Academy of Science.

‘Nature is better than books’

Not even Roland Harper fazed self-taught botanist Fanny Andrews

By Charlotte A. Ford

When Eliza Frances Andrews moved from Montgomery, Alabama, to Rome, Georgia, in 1911, she was already well-known as a botanist. Then 71 years old, she had botanized actively for a quarter of a century; had written two books, “Botany All the Year Round” (1903) and “A Practical Course in Botany” (1911); and published articles in Popular Science Monthly, Torreya, Chautauquan, Plant World, and Country Life in America.

Her main fame today may lie not in botany, but in her travel, social, and economic commentary on the Civil War era, “The War-Time Journal of a Georgia Girl, 1864-1865,” first published in 1908. In her own era, however, she was in rarer company as a published woman botanist in the South.

Fanny Andrews was born in Washington, Georgia, on August 10, 1840, the daughter of Judge Garnett and Annulet Ball Andrews. She graduated from LaGrange Female College in 1857 and taught at Washington-Wilkes, Yazoo City, Mississippi, Wesleyan Female College in Macon, and Dallas, Texas, at various times between 1871 and 1904.

In the 20 years she lived at Rome before her death in 1931, Andrews wrote primarily about botanical subjects in that vicinity, including ferns, galax, honeysuckle, and trees. She continued a correspondence begun with botanist Roland M. Harper around 1898 when she was teaching at Wesleyan. Forty-nine letters from Andrews (1901-1923) and 42 letters from Harper (1909-1926) are in the Roland M. Harper collection at the University of Alabama library.

Harper provided Andrews with copies of his own papers, which she kept for her files, and suggested sources of information she needed for her articles. She also often asked his help in identifying plants by describing them or sending specimens to him.

Much of Andrews’s research was done on Lavender Mountain, about 12 miles from Rome. Here at “Craney Crow,” a shanty owned by her cousins, she spent several summers.

The first summer, she found nearby a bed of *Galax aphylla* that intrigued her because of a faint carrion odor that seemed to emanate from it. Andrews wrote Harper (September 17, 1911) that she believed the smell was not in the plant. She had sent plants to the United States Department of Agriculture for analysis, and a botanist there had informed her that he had never heard of any offensive smell in connection with galax.

Harper replied that A.A. Heller had written in 1894 of galax in Virginia with an odor resembling a polecat’s, but did not connect it with the plant. (Editors’ note: Galax often grows under or near rhododendron, which can emit a skunk-like smell from a small mushroom, usually decaying, found on its leaves or stems.)

Andrews reported in “The Galax Odor” in *Torreya* in 1915 that after a two-year study she concluded the odor was found principally in leaves in warm weather and apparently was of no use in fertilization. After the article

came out, Harper wrote her to chastise her for not crediting Heller for the earlier study, which she had noted without attribution.

Soon Andrews was observing the resurrection fern, *Polypodium polypodioides*, which grew on short stems and roots of overgrown boxwoods in an old-fashioned garden at Valley View, a home owned by cousins near Rome. Resurrection fern shrivels up in dry weather and comes to life after rain showers.

Andrews became particularly curious about how long the fern could survive without water. In a 1920 article in *Torreya*, she told of her experiment to find out. She gathered a mat from a rocky hillside and placed "Little Polly" in her basement. Fourteen months later, the specimen finally died.

Fanny Andrews devoted much time to studying pines. She wrote Harper (April 24, 1914) that, except for those she identified as *taeda*, *virginiana*, and *palustris*, all pines she identified seemed to belong to one species, adding that *echinata* and *virginiana*, "so far as I can see," made up the pine woods around Rome. Harper identified the specimens she sent as *Pinus echinata*, the short-leaf pine.

Harper sent her an article on the long-leaf pine, to which she responded by beginning some "observations on the subject" (October 15, 1915). She reported that one pine grove in which all the trees were conical was so thick she could not get through it.

Around 1916, she began to focus on pollination of young cones. She believed it occurred in the second season. Harper knew she lacked access to scientific works and offered to find information on pine pollination for her (August 28, 1916).

In 1917, the *Botanical Gazette* published "Agency of Fire in Longleaf Pines" by E. F. Andrews. She wrote

Eliza Frances Andrews at 25 in an 1865 photo (top) and a much later one.



about two visits to a half-acre site on Lavender Mountain. The second came after a forest fire, and to her amazement she found 33 young long-leafs surviving though scarred by fire. She concluded that the blaze saved the pine seedlings from starvation and crowding-out by killing competing weeds and undergrowth.

Harper was surprised that the magazine accepted her article (January 9, 1918). Professional pique may have motivated him to tell her that only three of his 40 papers published in the last four years had been mentioned in the *Botanical Gazette* because, he thought, they "could not refute my work (so) they simply ignore it."

He also suggested that the way she "camouflaged" her name—by using initials—might cause readers to think he had discovered an unknown young man to confirm his statements. Andrews promptly replied that she had found it to be a disadvantage if her work were known to be by a woman, since men of science, teachers, and people generally were not disposed to take seriously the work of women scientists.

Andrews often took photographs that were used with her articles. For instance, to demonstrate how weedy the Japanese honeysuckle is in the wild, she illustrated a 1919 *Torreya* article with photos of the vine covering the side of a railroad cut near Rome.

Her photos illustrated "Oddities in Tree Stems" in *American Forestry* in 1919. Two showed stems twisted around one another, an elm and a haw in one and two dogwoods in the other. "Twin Trees and Natural Grafts," also in *American Forestry*, was accompanied by a photo of a white oak and a short-leaf pine to illustrate her "true twin...distinguished by a suture which follows their line of union down to the ground."

The last published work of Andrews, "Remarkable Behavior of a Veteran White Oak," appeared in *Torreya* in

1926. This short report expressed amazement that a "Methuselah of the forest" lived through a drought that killed healthy trees nearby. She speculated that the death of its competitors made more chemical nutrients available to the old-timer.

After her 80th birthday, Andrews wrote Harper that her field studies were almost entirely broken up by some terrible frights caused by watchdogs, bootleggers, and moonshiners (November 5, 1921).

Even though she claimed that she was no longer in the field, she continued to send Harper descriptions and specimens when she wanted his opinion. As late as 1923, they engaged in a spirited exchange about the similarities and differences among various species of *Celtis* and *Ulmus*, the hackberry and the elm.

Through the years, Andrews was also a prolific writer of subjects other than botany, turning out essays, travel articles, serials, political analyses, and three novels. She seemed indestructible.

Eliza Frances Andrews was 90 when she died in early 1931, her life having spanned presidencies from Martin Van Buren to Herbert Hoover. The years she spent tramping the trails around Rome, Georgia, were golden years. She loved the glorious mountain grounds she ranged.

A self-taught botanist, Andrews believed that botany was a practical study available to any interested persons, and she wrote in a clear style for such readers. Nature was her teacher, as she wrote Harper in 1918, "for our business, nature, after all, is better than books."

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Not heat or ticks or even the ambiguities of Ilex identities can dampen a graduate student's quest for knowledge

Happy holly days

By **Gregory A. Krakow**
Illustrated by the Author

This is a report of a slice of time from the middle of my work on a master's degree in plant taxonomy at the University of Georgia. As anybody knows who has been to or heard about graduate school, there is pressure and hard work.

Sometimes, things start happening almost too fast. One week, I received an award from the Holly Society of America. The next week, I went to Sapelo Island in search of *Ilex ambigua* (Michaux) Torrey and other botanical wonders in the midst of heat, mosquitoes, and ticks, only to return home with a bad case of Rocky Mountain spotted fever. I wrote this report while recovering!

The seed of the idea to attend the University of Georgia was planted when I visited the herbarium there on a Georgia Botanical Society field trip about six years ago. Four years later, I applied. Now I am happily immersed in my program.

At a certain point in a graduate program in plant systematics, one must choose a taxonomic problem. With some help from my major professor, Dr. Sam Jones, and from Dr. David Giannasi, I decided to work on several groups of the deciduous hollies.

On my list are: *Ilex decidua*, *I. ambigua*, *I. curtissii*, *I. longipes*, *I. beadlei*, *I. mollis*, *I. buswellii*, *I. montana*, and *I. amelanchier*. All of these hollies oc-

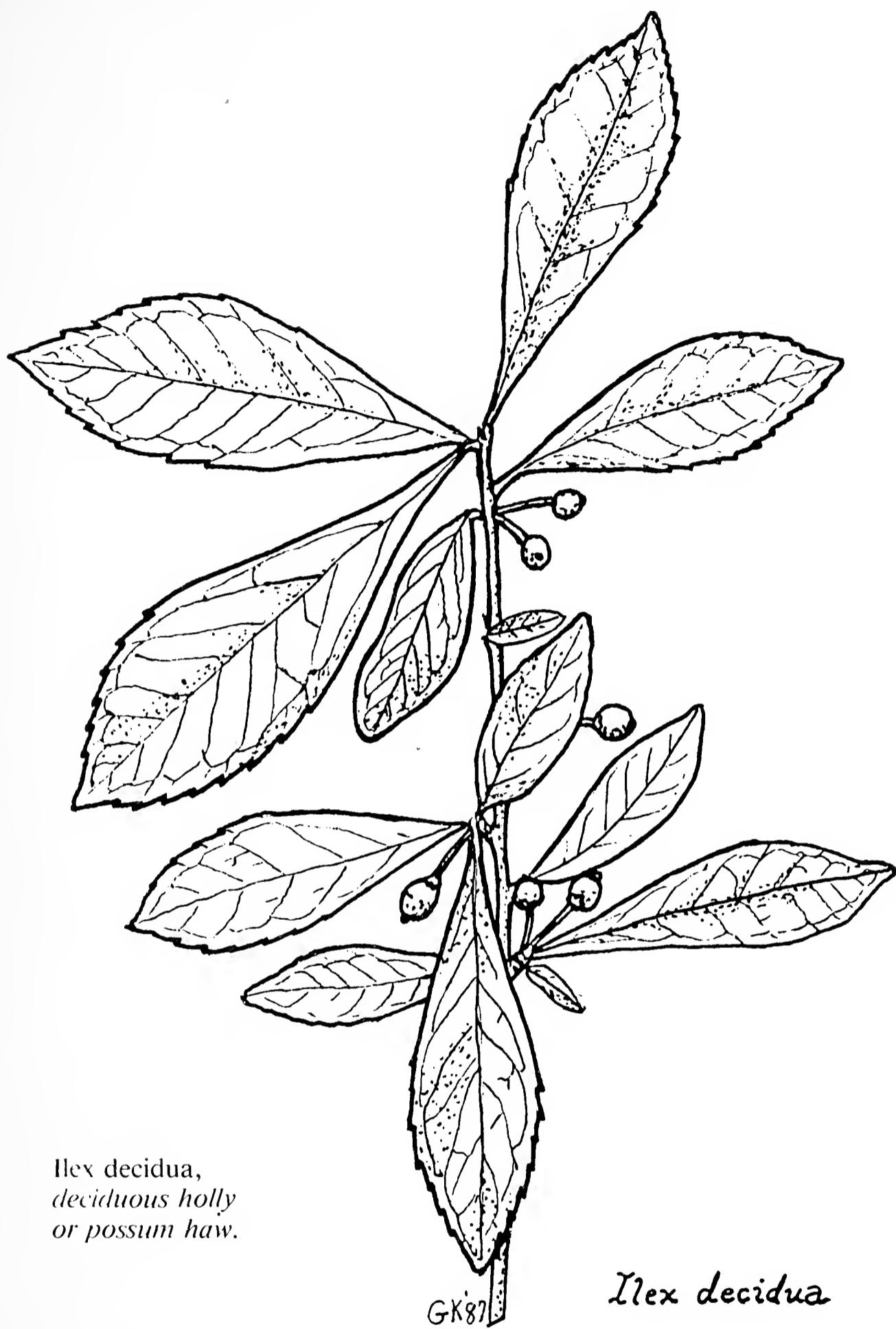
cur in Georgia and have in common a shrubby or small-tree habit and thin, spineless, deciduous leaves.

A search of the literature showed much disagreement in their classification and little work using modern taxonomic techniques such as chemical taxonomy or computer-assisted numerical techniques. My study uses computer-assisted analytical methods to examine the plant characters.

This involves spending long days determining leaf lengths and widths, pedicel lengths, number of teeth on the leaf margin, and other data for hundreds of herbarium specimens and feeding the information into a computer in the hope of revealing relationships between the different plant groups.

One of the first steps is to see the plants in the field. A basic way to locate plant populations is to use label data from herbarium specimens—a task more difficult than one might imagine. Often the location description is poorly written, and not very helpful. Or if the collection was made 15 or more years ago, the site currently may be a reservoir, shopping mall, parking lot, housing development, or highway interchange. Sometimes, fortunately, things haven't changed all that much.

Another difficulty—at the outset, anyway—was the similarity of many shrubs mixed in with the hollies. There



is no frustration like being confronted by masses of look-alike shrubs and never finding the hollies among them. Other botanists—for example, holly experts Ted Dudley and Gene Eisenbeiss of the National Arboretum—have spoken of similar frustration.

Eventually I learned several good field characters that aid my search. The best for me is the smooth, gray bark

which is often mottled with lichens.

Ilex decidua Walter, commonly called deciduous holly or possum haw, is often found growing on flood plains throughout Georgia, except in the mountains and foothills of the Blue Ridge.

I have seen pure stands of possum haw, of an acre or more, beside the Ohoopee River about three miles east of Oak Park in Emanuel County. It is not

found as frequently or as dependably in upland areas. Sometimes high banks and hills near rivers, streams, and lakes will support possum haw.

I. decidua is a shrub 12 to 20 feet high. Its leaves are the best way to distinguish it: 2 to 4 inches long, oblanceolate, short-toothed, and typically pubescent only on the midrib of the leaf undersurface.

Early in my field work when searching for this holly, I was often confused by swamp privet, sebastian bush, and various blueberries. Both swamp privet and sebastian bush have oblanceolate leaves, but, unlike possum haw, swamp privet's leaves are opposite and sebastian bush has entire leaf margins (not toothed). The reddish-brown, finely streaked bark of blueberries easily distinguishes them from possum haw.

A smaller-leaved form of *I. decidua* that some botanists have called *I. curtissii* (Fernald) Small occurs in northern Florida and a few areas of south Georgia. The leaves of *I. curtissii* are mostly 1.5 to 2 inches long. The smaller leaves may be due to influences of the local environment.

An isotype specimen of *I. curtissii* in the University of Georgia herbarium appears to be quite different from populations of *I. decidua* or so-called *I. curtissii* that I have been able to locate. Its leaves are under 0.75 inch long, and mostly narrowly oval instead of oblanceolate, and are much thicker and shinier than the leaves of *I. decidua*.

John K. Small's description of *I. curtissii* in his manual fits the characters of the isotype specimen as to the length and a thin, leathery quality of the leaves. But he gives the leaf shape as "spatulate to elliptic-spatulate, acute or obtuse"—nothing like the isotype. One suggestion is that Small's plant might be a hybrid between forms of *I. decidua*, possum haw, and *I. vomitoria* Aiton, yaupon holly.

Ilex longipes Chapman, the Georgia holly, also called Chapman's holly or long-pediceled holly, occurs mostly in

northwest Georgia in upland areas and along streams.

Georgia holly has bright, shiny, red fruits which are about 0.5 inch in diameter, with thin, arching fruiting stalks about 1.25 inches long. The leaves are 3.5 inches long and 1.5 inches broad, glossy, and coarsely serrate. The overall effect is quite attractive. Some

Ilex ambigua,
Carolina holly.



graduate students at the university have suggested that the plants resemble red cherry (*Prunus* species).

There is a large population in Sitton Gulch at the mouth of Cloudland Canyon, Dade County. Hundreds of fruiting shrubs ranging from about 3 to 12 feet tall are growing in sandy, rocky soil, on islands and banks of Sitton Gulch Creek, and on higher areas of the flood plain.

Another population of Georgia holly occurs northeast of Resaca in Gordon County near the point where Georgia Highway 136 crosses the Conasauga River. On a dry, sandy hill above the Conasauga are about 50 plants, which, judging from leaf and fruit variations,

are possibly hybridizing with possum haw.

Botanists disagree over the nearest relative of the Georgia holly. Just in the past 20 years, various authors have placed it not only with possum haw, *I. decidua*, but also with *I. ambigua*, the Carolina holly, and *I. verticillata* (Linnaeus) Gray, the black alder, or winterberry.

Just as the name implies, the lines of delineation within *I. ambigua* have been a confusing mess over the years. It has been split into five species—*ambigua*, *buswellii*, *beadlei*, *mollis*, and *montana*—by various authors. Other authors have had two varieties: *I. ambigua* var. *montana* and *I. ambigua* var. *ambigua*.

In its most commonly encountered form, Carolina holly occurs on drier soils in the Coastal Plain of Georgia. I have noticed that it frequently is about 100 yards from a source of water—for example, on the sand hills associated with creeks and rivers or in the mildly sloping, dry forests near south Georgia lakes.

Carolina holly is a shrub usually about 12 feet high, but I have seen some leggy plants of nearly 30 feet. The leaves are somewhat oval, light gray-green, obtuse or acute at the base, short acuminate at the apex, 1.5 to 2.5 inches long.

Observing plants along a straight line as the environment graded from a dry, open sand hill into a wet, dense swale, I noticed the plants varied from typical *Ilex buswellii* Small into *I. ambigua*. This leads me to suspect that *buswellii* is genetically identical to *ambigua*, but altered by the environment.

A holly found abundantly in the mountains is the appropriately named *Ilex montana* Torrey and A. Gray. It is on top of most mountains in north Georgia. A good place to look would be along the loop road surrounding the top of Brasstown Bald.

I. montana is also called mountain winterberry or large-leaved holly. It has very large leaves for a holly, sometimes

7 inches long or longer. The fruit is dark red and translucent. This holly can occur sporadically in the Piedmont and Coastal Plain.

I. amelanchier, sarvisberry holly, is found on the Coastal Plain of Georgia. It has been reported to be rare, but further investigation of its habitat—the edge of rivers, streams, and swamps—might show more frequent occurrence. I have thought that a canoe trip down the Altamaha River to investigate alluvial swamps might turn up many populations.

The leaves of sarvisberry holly are more oval than other deciduous hollies. They also have a distinct, fine, net venation on the undersurface. This holly has peach-colored berries on medium-long stalks.

Usually *I. amelanchier* is around 12 feet tall, but I have seen some up to 30 feet. When it grows in the dense shade of swamps and flood plains, it tends to be spindly and tall with dark green leaves. In places where it gets more sun, it tends to be shorter and densely foliated with leaves of an unusual blue-green cast that is quite attractive.

I have located an apparent county record of *I. amelanchier* where U.S. Highway 80 crosses Lotts Creek about 11 miles southeast of Statesboro, Bulloch County.

Working with hollies has helped me become familiar with many of Georgia's diverse plant habitats. I look forward to field work throughout the Southeast.

I also plan to look at thousands of *Ilex* herbarium specimens from all over the world and spend hundreds of hours looking through dissecting scopes, sitting at word processors, going through reams of data, reading journal articles, going to conferences and symposia, and doing the general everyday things any graduate student must do.

Regardless of the amount of work involved, it is an incredible experience to be able to devote one's life to the study of plants.

‘. . . as if that sky let fall a flower from its cerulean wall’

Gentiana crinita is a late bloomer, and hard to find in Georgia, but it is absolutely sensational



To the Fringed Gentian

By William Cullen Bryant

Thou blossom bright with autumn dew,
And colored with the heaven's own blue,
That openest when the quiet light
Succeeds the keen and frosty night,

Thou comest not when violets lean
O'er wandering brooks and springs unseen,
Or columbines, in purple dressed,
Nod o'er the ground-bird's hidden nest.

Thou waitest late and com'st alone,
When woods are bare and birds are flown,
And frost and shortening days
portend
The aged year is near his end.

Then doth thy sweet and quiet eye
Look through its fringes to the sky,
Blue—blue—as if that sky let fall
A flower from its cerulean wall.

I would that thus, when I shall see
The hour of death draw near to me,
Hope blossoming within my heart,
May look to heaven as I depart.

By Thomas S. Patrick

The fringed gentian (*Gentiana crinita* Froelich) is found in few localities in Georgia. Flowering in autumn with dark blue petals as delicately fringed as the daintiest lace, this member of the gentian family (Gentianaceae) is awe-inspiring, especially in mass. Sometimes, in favorable years particularly, the blue contrast of such a mass of gentians with the burnished color of falling leaves can be a sight to behold.

Most reference books place the fringed gentian in the genus *Gentiana*, as we have treated it here. However, some taxonomists prefer the genus *Gentianopsis* because, unlike the bottle, closed, and soapwort gentians, the flower parts of the fringed are in fours instead of fives, the plants are annuals or biennials rather than perennials, and genuine gentian-like pleats between the petal lobes are absent.

Tracking a population of fringed gentians is a challenge. Since the seeds are minute and covered with papillae (nipple-shaped protuberances) that allow them to be wind-borne, at least for short distances, entire populations are likely to move or disappear.

Providing management for gentians also can be tricky. They may inhabit roadsides and be dependent upon a specific mowing schedule, or they may be found in old fields where they are subjected to changing amounts of shade as plant succession proceeds. In the latter situation, selective cutting of trees, bushhogging, periodic grazing, or fire may prove to be helpful management tools.

Gentiana crinita is found from New England west to southern Manitoba, then southward into the Midwest, reaching Georgia only in the Blue Ridge adjacent to North Carolina. There are no known populations of fringed gentians in Tennessee.

The species is genuinely rare in Georgia. What restricts it? The answer to this intriguing question is most likely related to the preference of *Gentiana crinita* at the southern end of its range for ultramafic rock—bedrock high in magnesium. A band of ultramafic rock extends from northeast Georgia into Clay County, North Carolina. Fringed gentian is also found on this outcrop in North Carolina. The associated vegetation is stunted and open-grown, allowing the sun-loving fringed gentian to persist.

Besides its annual or biennial nature and specialized habitat requirements, other attributes may restrain the species in Georgia. Perhaps the delicate seeds are finely tuned to a moisture regimen, mineral soil exposure, a certain temperature or light quality before germination can ensue.

One thing is without question: The elusive fringed gentian is one of our showiest mountain species, a rewarding native beauty well worth the quest.

Taking it for granite

By early spring, when red carpets of diamorpha appear, rock outcrops begin to show off an array of plants that continues through summer's heat and winter's cold

By David L. Emory

Illustrated by Margery Borom

With winter just around the corner, wildflower enthusiasts are already thinking of the floral delights that await them in the coming year. Probably the best place to see multitudes of flowers quite early in the season is a granite outcrop.

Unlike a woods, where the blooming plants are likely to be scattered or in small patches, an outcrop offers dazzling masses of intense color by the beginning of April: red carpets of diamorpha, white drifts of sandwort, and yellow patches of woolly groundsel, soon followed by blue strands of phacelia.

William Bartram, describing the site where his party camped June 27, 1776, wrote what may be the first account of a granite outcrop, a place he called "the Flat-rock." Rogers McVaugh says it probably was an outcrop in Warren County near the present town of Camak, 40 miles west of Augusta, a place that Francis Harper identifies as Lazenby's Rock.

Bartram wrote that "...in the loose rich soil verging round this rock grew several very curious herbaceous plants..." Among them was "one of singular elegance and beauty which I take to be Ipomea (sic)." The plant had an erect stem, plumed leaves, and rose-colored flowers sprinkled with crimson. According to Harper, it was *Gilia rubra*, standing cypress.

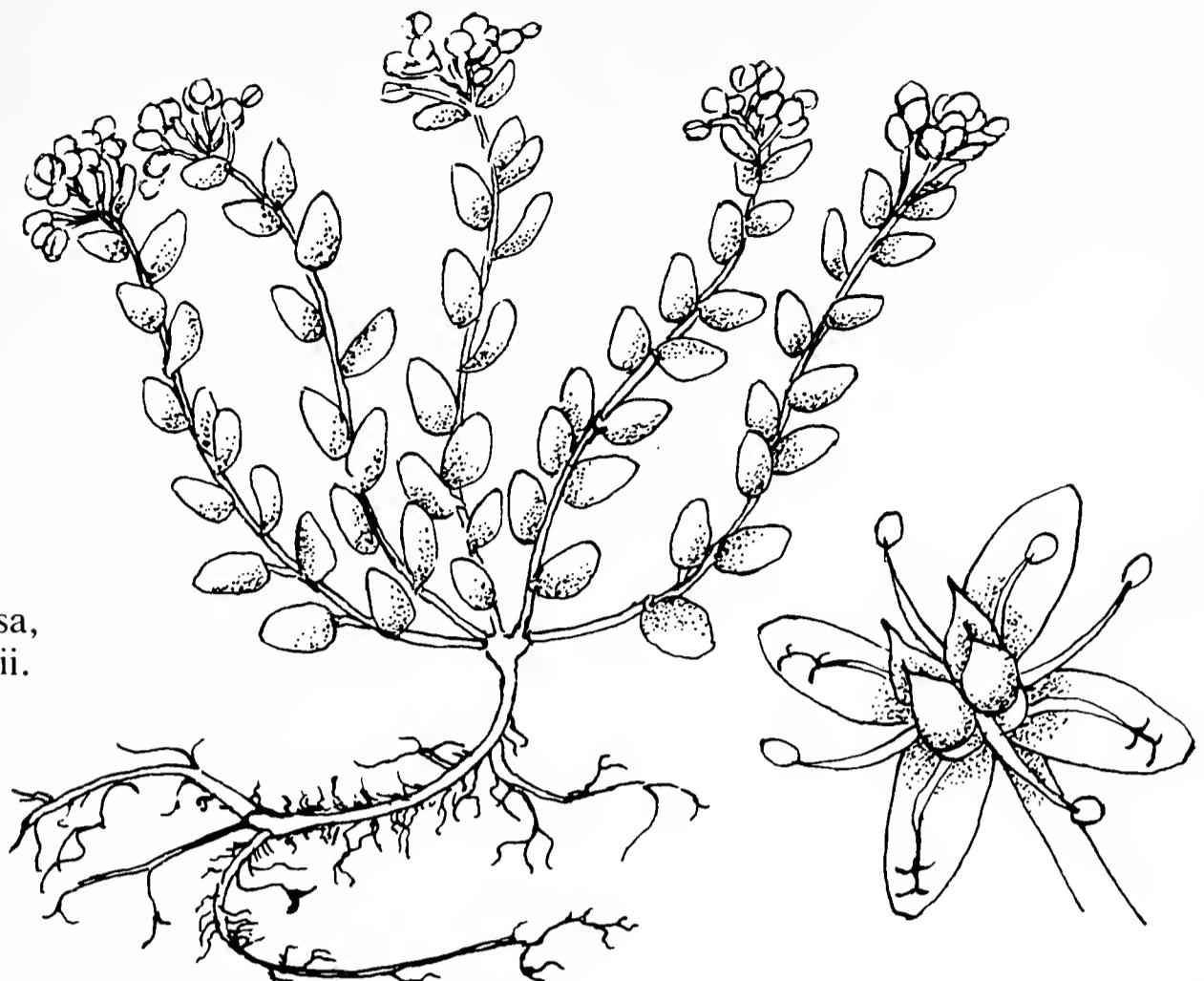
McVaugh in 1940 described a granite outcrop as "a flowering desert in miniature"—an apt comparison in

many respects: No shade. Very intense light all year long. The rock, and the air above it, often unbearably hot in summer. Winter and nights sometimes quite cold in the absence of ameliorating influences. No shelter from the wind. Little or no water, except in small depressions that hold winter and spring rain until it evaporates as summer approaches. Much of the outcrop has no soil, and only lichens and mosses can establish themselves on the bare rock.

Because of this harsh environment, the plants that can survive are likely to be endemic species, found nowhere else, that have adapted to it in various ways. Being highly specialized, these plants do very well on the outcrop, where they have no competition. In more moderate conditions, where many plants thrive, they cannot compete.

In 1943, McVaugh listed 17 taxa he considered endemic to the granite outcrops of the Southeast. All have been reported in Georgia. His list is as follows:

Isoetes melanospora,
black-spored quillwort
**Panicum lithophilum*,
stone-loving panic grass
Cyperus granitophilus,
granite-loving sedge
Rhynchospora saxicola,
rock-dwelling beak-rush
Juncus georgianus,
Georgia rush
Quercus georgiana,
Georgia oak
Sedum pusillum,
dwarf stonecrop
Portulaca smallii,
portulaca



Diamorpha cymosa,
now *Sedum smallii*.

- **Lotus helleri*,
birdsfoot trefoil
- **Hypericum splendens*,
Stone Mountain St. John's-wort
- **Oenothera linifolia* var. *glandulosa*,
flax-leaved primrose
- **Oenothera fruticosa* var. *subglobosa*,
sundrops
- Phacelia dubia* var. *georgiana*,
Georgia phacelia
- Amphianthus pusillus*,
amphianthus
- **Gerardia tenuifolia* subsp. *polyphylla*,
Stone Mountain gerardia
- **Liatris microcephala*,
small-headed blazing star
- Viguiera porteri*,
Confederate daisy

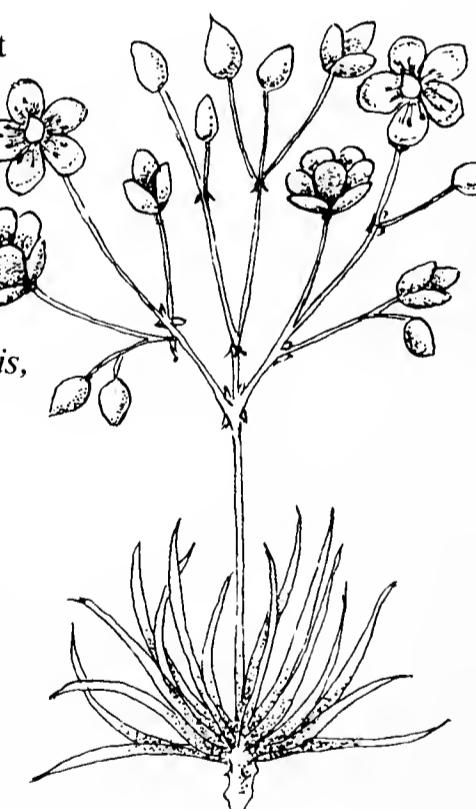
Since 1943, further studies suggest that the starred species (*) should be removed from the list. For example, the varieties or subspecies of *Oenothera* and *Gerardia* are no longer recognized as valid taxa by Wilbur H. Duncan and J. T. Kartesz in their 1981 checklist of Georgia vascular flora.

Also, two species could be added to the list of endemics: *Phacelia maculata*, considered an endemic by William H. Murdy of Emory University, and *Isoetes tegetiformans*, a mat-forming quillwort discovered by Phillip M. Rury on Heggie's Rock in Columbia County, near Augusta, in 1978.

McVaugh in 1943 also listed 27

species commonly associated with granite outcrops, as follows:

- Cladonia caroliniana*,
a lichen
- Riccia dictyospora*,
a liverwort
- Isoetes melanopoda*,
black-footed quillwort
- Pilularia americana*,
pillwort
- Agrostis elliottiana*,
a grass
- Fimbristylis annua*,
a sedge
- Scirpus carinatus*,
a sedge
- Tradescantia hirsuticaulis*,
hairy spiderwort
- Commelinia erecta*,
a dayflower
- Allium cuthbertii*,
striped garlic
- Nothoscordum bivalve*,
false onion
- Schoenolirion croceum*,
sunnybells
- Agave virginica*,
rattlesnake master
- Talinum mengesii*,
rock portulaca
- Talinum teretifolium*,
rock portulaca
- Portulaca coronata*
(now *P. umbraticola*),
rock-moss rose
- Arenaria brevifolia*
(now *A. uniflora*),
sandwort
- Diamorpha cymosa*
(now *Sedum smallii*),
diamorpha



Talinum teretifolium,
rock portulaca.

Trifolium carolinianum,
Carolina clover
Polygala curtissii,
Curtiss's milkwort
Crotonopsis elliptica,
rushfoil
Forestiera ligustrina,
outcrop privet
Phacelia hirsuta
(now *P. maculata*),
phacelia
Lindernia monticola,
rock pimpernel
Hedyotis crassifolia
(*Houstonia pusilla*),
star bluet
Coreopsis grandiflora,
rock-dwelling tickseed
Senecio tomentosus,
woolly groundsel

One might add a few more species frequently seen on outcrops, though they may do as well or better elsewhere: *Cheilanthes lanosa* (hairy lipfern), *Hypericum gentianoides* (pineweed), *Opuntia compressa* (prickly-pear cactus), and *Penstemon australis* (southern beardtongue).

Granite underlies much of the Piedmont in the southeastern United States. An area about 700 miles long and up to 120 miles wide, stretching from eastern Alabama to southern Virginia, has at least 8,000 acres of outcrops.

Georgia has the greatest share, with at least 6,000 acres. A map published by Charles H. Wharton in 1978 shows a band of outcrops across the state from Carroll and Muscogee Counties in the west to Elbert and Columbia in the east. DeKalb County alone has 2,000 acres and Walton and Rockdale over 1,000 each.

The best-known outcrop in Georgia is Stone Mountain, in DeKalb County east of Atlanta. Now a state park, this outcrop has received such heavy recreational use for a century or longer that much of the original and interesting vegetation has been destroyed.

For enjoying wildflowers, two of the best outcrops in Georgia are Panola Mountain and Heggie's Rock.

Panola is in Rockdale County almost due south of Stone Mountain. It is maintained by the state as Georgia's on-

ly conservation park. State ranger-naturalists provide slide lectures in a small museum and guided hikes on the mountain.

Heggie's Rock in Columbia County west of Augusta is a 92-acre outcrop owned by the Nature Conservancy. Albert E. Radford and D. L. Martin in 1975 called it "the most outstanding potential Natural Landmark site in eastern North America."

Heggie's is home to 11 of McVaugh's endemic species and 21 of his characteristic outcrop species. There also are several rare and disjunct species, as well as what Wharton calls "the best mat zonation and succession communities."

The two species probably most widely associated with granite outcrops are diamorpha and the Confederate daisy—the first and the last to put on a spectacular show of color each year.

Diamorpha is a winter annual. The plant is reddish, with white flowers, and it forms dense colonies that clothe the rock with beauty. It completes its brief life cycle in winter and early spring, finishes its seed formation by mid-spring, and then dies. Only the seeds manage to survive the nearly impossible summer months of heat and drought.

The dead plant protects the seeds by holding them nearly four inches above the hellish sand. Only when temperatures begin to moderate in September does it release them to fall into the soil, where they are ready to germinate as soon as there is sufficient moisture.

Usually seedlings are not successfully established until November. They remain tiny throughout most of the winter, but close examination of most sandy depressions on an outcrop will reveal the very small reddish plants.

They grow taller during February and March and bloom at the end of March or in early April. The white flowers seem like a sprinkling of sugar or snow on the nearly solid red carpets that cover large parts of the outcrop.

Robert Wyatt reported in 1981 that a common species of ant is diamorpha's primary pollinator. Some pollen is also distributed by bees. When insect pollinators are excluded experimentally, seeds are not produced, nor will plants artificially self-pollinated produce seeds.

Viguiera porteri, the Confederate or Stone Mountain daisy, produces great masses of yellow flowers in September. Many people have the mistaken impression that it is to be seen nowhere except on or near Stone Mountain. Actually it is found in nearly all counties of the Georgia Piedmont with granite outcrops.

Another interesting, less familiar winter annual of the outcrops is *Amphianthus pusillus*, illustrated by Mozelle Funderburk in the May 1987



Viguiera porteri, the Stone Mountain or Confederate daisy.

Tipularia. It is found in water in shallow depressions, or solution pits, and in early April a small white flower opens between two floating leaves. Fruit and seed are soon produced.

Other winter annuals among outcrop species are whitlow-wort, dwarf stonecrop, phacelia, and sandwort.

A number of plants are succulents, with fleshy leaves or stems that store moisture from spring rains to help them through the hottest part of summer. These include prickly-pear cactus, rattlesnake master, rock portulaca, and rock-moss rose.

Another adaptation is a low ratio of surface area to volume. This reduces the rate of transpiration, the loss of water by evaporation from the surface. Cactus is the best example, though the same characteristics may be significant in rock portulaca and even pineweed.

Hairiness also reduces the rate of transpiration. Hairy lipfern and hairy spiderwort are among a number of hirsute plants found on outcrops. Rushfoil has leaves and stems covered with silvery scales. Might these also help reduce the loss of water or, more imaginatively, could the silvery color serve to reflect a portion of the intense sunlight?

Considerable scientific research has been done on granite outcrops by faculty members and graduate students at Emory University. A continuing interest in the area of ecology is the study of plant succession—the sequence of plant communities.

Beginning with the first pioneers on bare rock, each stage modifies the environment sufficiently to make possible invasion by the next group of plants, which are then more successful than the previous group, gradually crowding out most of them.

Madeline P. Burbank and Robert B. Platt, who are familiar to many members of the Georgia Botanical Society, initiated studies on a number of "island communities," which develop in soil-filled depressions that rarely contain standing water. Continued on page 35

Wild in the city

By Jerome Drown

House-hunting is a tedious and boring enterprise, and you don't expect it to yield any great botanical rewards. But in our case it led to an oasis in a concrete environment, and for more than 30 years my wife and I enjoyed a secluded mountain home in the very heart of Atlanta.

It started back in the early '50s when we grew tired of apartment life and began to explore the mysteries of home ownership. After several months and a few heart-breaks, we spiraled our search beyond the city limits, but even in the country we couldn't find anything we could afford on an anemic budget.

I was driving through an established in-town neighborhood one day when I noticed a low, wooded area with a steep hill along one side. It was too choked with honeysuckle to afford a clear view, so I stopped, made my way through the underbrush, and stepped into a miracle!

There in front of me was a magnificent forest of huge beech trees, with oaks, hickories, poplars, and wild magnolias, and a small stream meandering lazily along. Incredible!

I had stumbled onto the largest lot in the subdivision, well over an acre. It was considered unbuildable because of the terrain, so the price had been cut in half. About seven acres more of woods adjoined it at the back. Our search was over.

We went 200 feet back to a hillside overlooking the stream and tucked our house in among the trees. We cleared the honeysuckle, but left everything else as we found it, including the hepaticas, bloodroot, rue anemones, and trilliums.

Then we brought in rhododendrons and mountain laurel to go with the native azaleas and sweet-shrubs and added trout lilies, shooting-stars, and other old friends as we could.

This became a cool retreat even in scorching Atlanta summers, with the stream and the canopy of trees furnishing natural air conditioning. Instead of cutting grass on the weekend, I could go outside and photograph wildflowers or help the neighborhood kids

find crawdads in the stream. In this delightful place, every day I spent at home was like a month in the country.

Now we are retired and have left Atlanta for the true country life in the mountains, but we'll never forget how lucky we were to have our own private wilderness in the heart of the city.

Beginner's botany

By Anselm Atkins

Concentrating first on a particular group of wildflowers is an advantage for beginners. It gives a firm base of familiarity from which to branch out. When I began learning wildflowers seriously in 1974, it happened quite by chance, but very easily, that I fell into a special relationship with the mint family.

Perhaps it was the excitement of a thick patch of showy blue skullcaps beside a cold trout stream. Maybe it was always having those square stems to go by. Or the great variety of color, form, and fragrance in the flowers—and so many genera to keep straight. Finally, in the dead of summer, there was always the gathering of horsemint for tea and liqueur (add vodka and sugar).

The following spring I found myself drawn to another common group: the violets (*Viola*). First, among patches of snow, came the yellow halberd-leaved, *V. hastata*. Later my mountain hikes exposed me to *rotundifolia*, *rostrata*, *selkirkii*, *cucullata*, *palmata*, *pedata*, *sagittata*, *papilionacea*, *canadensis*, *pallens*, and *renifolia*.

New habitats increased the list. The first thing I encountered when I stepped onto Daufuskie Island, off the South Carolina coast, was a *lanceolata*. Now, at property we have near Midway, in coastal Georgia, I find *primulifolia*. At home in Decatur, Georgia, I have Confederate, along with white and purple forms of the common.

And orchids. The lily-leaved twayblade that I almost stepped on while examining a pedestrian little spiderwort. The uncommon three birds orchid, *Triphora trianthophora*, that I chanced upon in a rocky cove. The grass pinks spotted in a field. That one cool cove carpeted with showy orchis. The yellow-fringed I met face-to-face while scrambling down a rugged mountain. Each member of this group I find, I remember where I found it.

Beauty and the beech

*For Fagus grandifolia,
a grand tree all year,
winter is glory time*

By **Rebecca Nunan**

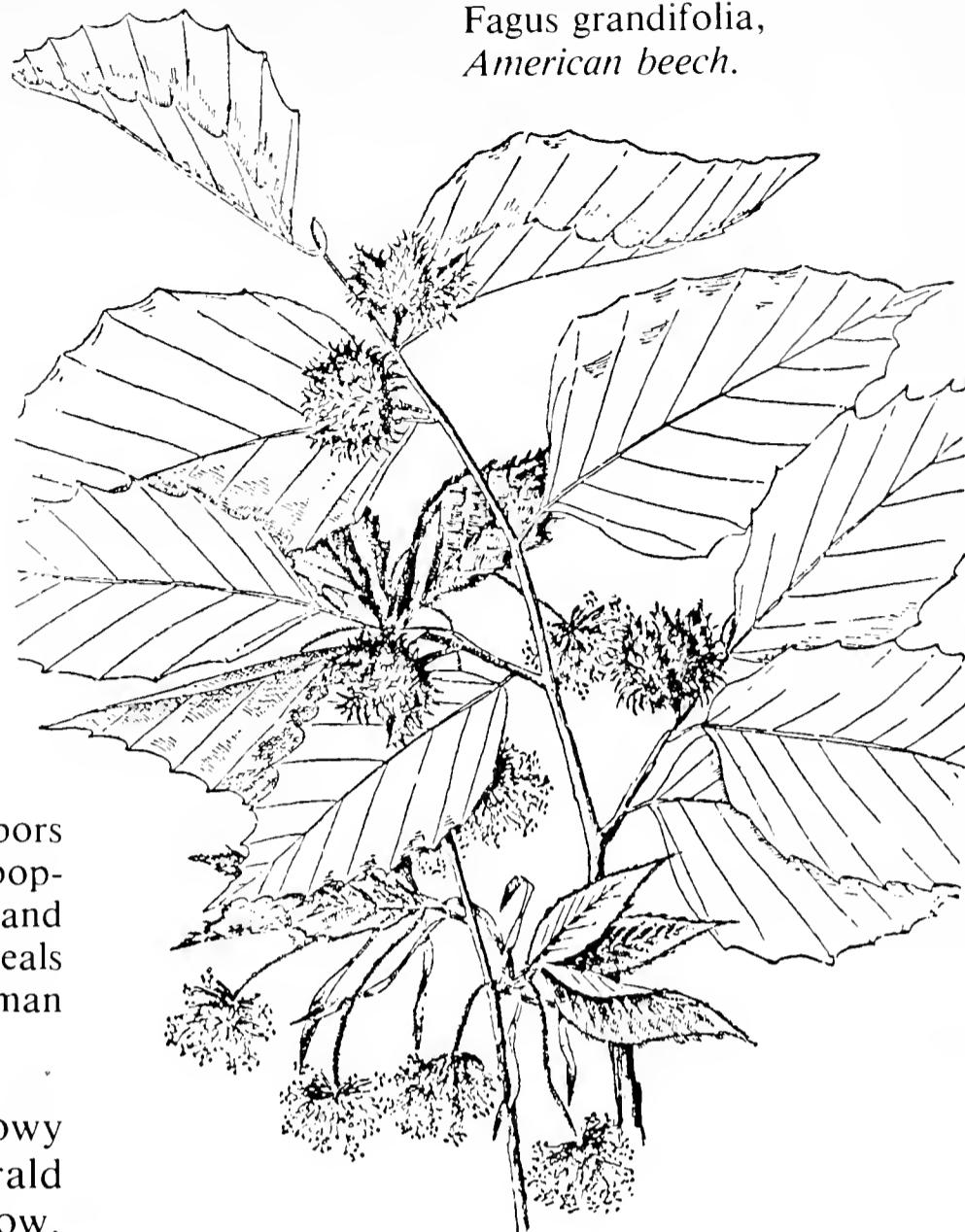
“A tree shades man and beast, harbors songbird and squirrel, feeds bee and looping worm. Aided only by the sun, rain, and earth itself, it lives with the seasons, heals its own wounds, and outlives its human neighbors.”—*Hal Borland*.

I love trees. All the trees with showy blossoms: the redbuds that herald spring, the dogwoods that soon follow, wild crabapple, and princess trees. But my feelings are quite as strong for many that do not announce the approach of spring with such a splendid display. White pine and weeping willow, sourwood and sycamore, scarlet oak and hemlock are just a few of my favorites. Another is the beech.

My love for the beech tree goes back some 60 years to a late April day in the woods when trees for me were simply divided into oaks and pines. My Girl Scout leader introduced me to the fact that there are many other kinds of trees.

She taught me how to recognize beech trees. She showed me the smooth, light-colored bark and the long, pointed, shiny brown buds set at an angle to the twigs. Removing the scales from one bud, she exposed a tiny, accordian-pleated leaf just ready to unfold.

Many of the beeches in that wood still had most of their leaves, and my leader explained that beeches kept



*Fagus grandifolia,
American beech.*

some of their leaves through the winter. I picked one of the leaves, expecting it to crumble in my hand, but to my surprise it was still quite firm.

Since then, I have shown these same characteristics to many children and watched the wonder in their eyes at seeing the new little leaf so cleverly concealed. Last winter I taught my 3-year-old grandson to spot winter beeches. He had good opportunity to practice because my hillside abounds in beeches of all ages firmly holding on to their leaves through the winter.

The old leaves’ clinging ways are not the beech’s only distinctive feature. The bark stands out year-round: thin, smooth, light bluish gray on young trees, darker pewter gray on mature trees.

Simply stated, other characteristics are:

Buds—elongate, acute, covered with overlapping, lustrous brown scales.

Leaves—alternate, coarsely serrate,

paper thin, shiny green, feather-veined.

Flowers—inconspicuous, appearing with the leaves, male and female separate on the same tree, staminate in round heads an inch in diameter on long, drooping stems, pistillate with two- or four-flowered spikes on 0.5- to 1-inch stalks.

Fruit—three-angled nuts in pairs of usually two or sometimes three enclosed in a bur covered with soft prickles.

All these details apply to the American beech, *Fagus grandifolia* Ehrhart, the only species native to North America of the 10 known species. Beeches grow throughout the world in temperate regions of the Northern Hemisphere.

The American beech is a member of a large family of trees and shrubs, Fagaceae, known as the beech family. Another member of the family is the oak, of which there are numerous species. Hugh Johnson has written in "International Book of Trees":

"Odd that the beech has not seen fit to diversify in the same way as the oak. The eight or nine species (*sic*) are almost interchangeable, save for the bigger, smaller, longer, or rounder leaf. The beech is clearly at the logical end of its evolutionary road, just as it is the final winner in a struggle for dominance in the forest."

The floor of beech-maple forests often is covered with beech seedlings—an indication of the beech's becoming the dominant tree. Two factors help the beech to secure its space in the forest. Its low-spreading limbs provide deep shade and its many fine roots fill the surface of the ground, thus shutting out competition.

Beeches prefer well-drained soil with plenty of moisture in the upper layers. They attain their largest size in alluvial bottomlands of the Ohio and lower Mississippi river valleys and along the western slopes of the southern Appalachians.

American Forests magazine, in its

1986 update on big trees, lists a tree in Ashtabula County, Ohio, as the champion beech of the United States. Its dimensions are: circumference (at 4.5 feet), 222 inches; height, 130 feet; spread, 75 feet.

Georgia's largest beech tree is where one would hardly expect to find it—in Atlanta. It is about one block east of West Peachtree Street on the grounds of the Theosophical Society at 36 Thirteenth Street NE.

A plaque set in concrete identifies this beech as a registered specimen tree, so designated by the city's Tree Preservation Review Board April 2, 1979. Its dimensions are: circumference (at 4.5 feet), 183 inches; height, 100 feet; spread, 111 feet.

This tree was impressive enough to cause the Metropolitan Atlanta Rapid Transit Authority (MARTA) to change the location of a tunnel in the area.

Fagus sylvatica Linnaeus, the European beech, with its many distinctive varieties, is a popular ornamental in the United States. No outstanding horticultural varieties of the American beech have been developed.

Through the centuries the beech has been one of the most economically productive of trees. Early Europeans used both the nut and an oil extracted from it as food. They fed the dried leaves as winter forage for their cattle. Some people stuffed pillows and mattresses with the dried leaves.

An 18th century traveler in America noted that the Potawatomi Indians made a concoction of the leaves which was "a certain and expeditious cure for wounds which arise from burning and scalding as well as a restorative for those members that are nipped by frost."

From the wood, they made excellent bowls for chopping food. They preferred the curly or wavy portions because its increased hardness would resist sharp edges of tools.

The beech also provided food. To gather the nuts in quantity, the Indians

relied on the deermouse's store, which often contains four to eight quarts. They located it by the refuse on the snow.

Beechnuts contribute to the diet of other wildlife: raccoons, ruffed grouse, wild turkeys, quail, ring-necked pheasants, squirrels, bears, deer, and many more. By carrying away the nuts, which are not adapted for wind dispersal, many of the animals help to insure a future food supply by planting new trees.

The wood has characteristics that make it economically important. "Beechwood is light in color, heavy,



The American beech bears edible nuts that are enclosed in a soft-spined bur.

hard, strong, close-grained, and difficult to split," W. M. Harlow wrote in "Masterpiece of Nature." "A cubic foot when air-dry weighs about 45 pounds. It shrinks considerably in drying and is not durable when left in contact with the soil, but it takes a high polish and wears well when subjected to friction under water."

Beechwood has been used to make furniture, flooring, railroad ties, handles, shoelasts, veneer, firewood, and, because of its clean odor, barrels, and boxes for fruits and vegetables.

History, folklore, and mythology have their share of beech stories. Alexander Porteous details many of them taken from the writings of early Romans.

Pliny tells of a grove of beech trees on a hill near Tusculum sacred to Diana, goddess of hunting. Here the

foliage was so beautiful that it seemed to be trimmed by art. Legend has it that Athena and Apollo, in the form of vultures, sat on a beech and watched the Trojan War.

Passienus Crispus, an orator, loved one beech so much that he would embrace and kiss it, lie down under it, and water it with wine.

Closer to the present is the story of how Johannes Gutenberg got the idea of printing from movable type. Sitting under a beech and whiling away the time whittling, he carved a few letters and wrapped them, still wet, in a paper. When he unwrapped them, he was astonished to find impressions of the letters on the paper.

That may or may not be what happened, but it is a fact that Gutenberg's first letters for his printing press were made of wood, and it is believed it was beechwood. The German word for letters, *Buchstaben*, is partly derived from the German for beech, *Buche*.

Even if it had no practical value, the beech would still be one of the most appreciated trees for its beauty alone. Slender, angled twigs clustered toward the ends of the limbs give the whole tree a rather delicate, ruffled appearance. When it is full-grown, it is massive, but still elegant.

It is difficult to choose the season when the beauty of the beech does most to lift the spirits of the beholder. In spring, its branches are covered with pale, silvery green leaves, lighter than the leaves of many other trees. Through summer the leaves turn a little darker, but retain their almost spring-like freshness until autumn turns them a golden bronze.

But winter is surely the beech's time of glory. Unlike most trees, it does not become a bare silhouette against the sky. The leaves, now light to dark tan, cling to the twigs until the end of winter, fully clothing the younger trees and trimming only the upper limbs of the mature trees. This characteristic of the older trees only adds to the beauty of the individual trees and of the forest

as a whole, since it exposes the still unfurrowed steel-gray bark.

A bonus of beeches is the interesting plant often found where they grow: beechdrops, a pale brown plant with tiny whitish-purplish flowers. As its botanical name, *Epifagus virginiana* Linnaeus, indicates—*epi* from the Greek prefix for upon, *fagus* for the tree's genus—it is parasitic on the roots of the beech.

Unfortunately, the smooth, gray bark of the beech is often irresistible to carvers, who disfigure the tree for life with initials inside hearts and other symbols. These inscriptions have led to a standing joke among botanists and tree lovers that each beech tree can be recognized by its own distinctive markings.

Apparently this phenomenon has been around a long time. Shakespeare has a reference to carving in "As You Like It" as he has Orlando say:

O Rosalind! these trees shall be my books
And in their barks my thoughts I'll
character;
That every eye, which in this forest looks,
Shall see thy virtue witness'd everywhere.
Run, run, Orlando; carve on every tree
The fair, the chaste, and inexpressive she.

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Look a little lower

*The Lilliputian world
of mosses is full
of surprising sights*

By Hal Massie

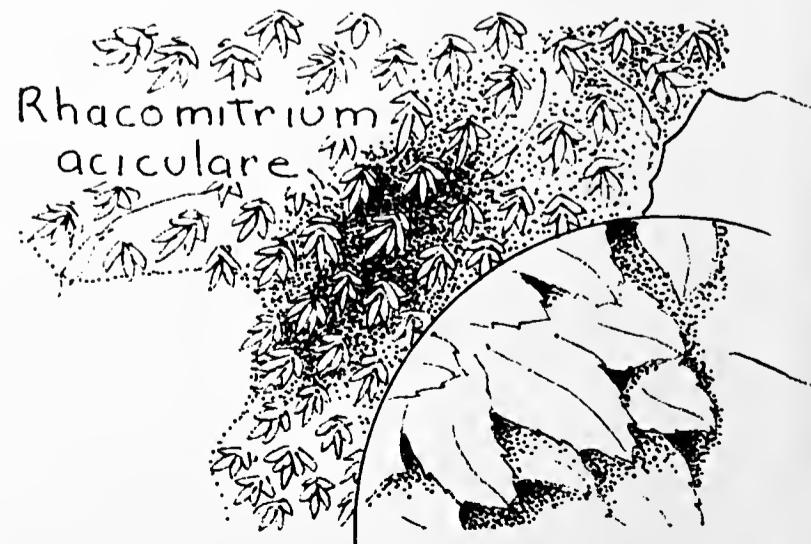
Mention moss to Southerners, and most of them will think of gray strands of Spanish moss hanging from huge live oak trees. Some will think of the small, sponge-like clumps of reindeer moss, others of the trailing green fronds of clubmoss.

None of these is actually a moss. Spanish moss is a flowering plant of the bromeliad family. Reindeer, or deer, moss is a lichen. Clubmoss is a primitive vascular plant, a fern ally, of the genus *Lycopodium*.

Diminutive and inconspicuous, mosses may not be very well known, even to some botanists with years of field experience, but they are worth the trouble to study and under close scrutiny reveal themselves as delicate and beautiful.

Mosses, like liverworts and hornworts, are bryophytes—plants without vascular tissue. They do not have

Illustrated by Anselm Atkins



leaves, stems, or roots, as vascular plants do, though most texts on bryophytes may use the terms stem and leaf for the sake of simplicity. (This author will do the same.)

Having no leaves to absorb water directly, mosses depend on ground water, especially for reproduction. Rhizoids, which resemble roots, serve only to anchor the mosses to the ground or other surface.

Although most of the mosses do reproduce sexually, some are not known to have any capability for sexual reproduction. Nearly all, however, are able to propagate themselves asexually by various means, including propagules, leaf fragments, stem fragments, and specialized structures known as gemmae. (*Propagule* is a botanical term for a propagative part, as buds or shoots, and *gemma* is a cell or cluster of cells, or a leaflike or budlike body, that separates from the parent plant to form a new plant.)

Possibly the single most unusual aspect of the mosses is their particular scheme of alternation of generations. Without all the details of how the scheme works, here is what happens:

In mosses, the leafy plant that we are familiar with is the gametophyte, or haploid, generation of the plant's life cycle. The gametophyte reproduces sexually by fusion of sperm and egg, and the resulting embryo develops into a completely different plant, the diploid sporophyte generation.

The sporophyte is not on its own, however. It is anchored to the

gametophyte and, somewhat like a parasite on its host or a fetus in the mother's womb, is partially dependent on it for nutrition.

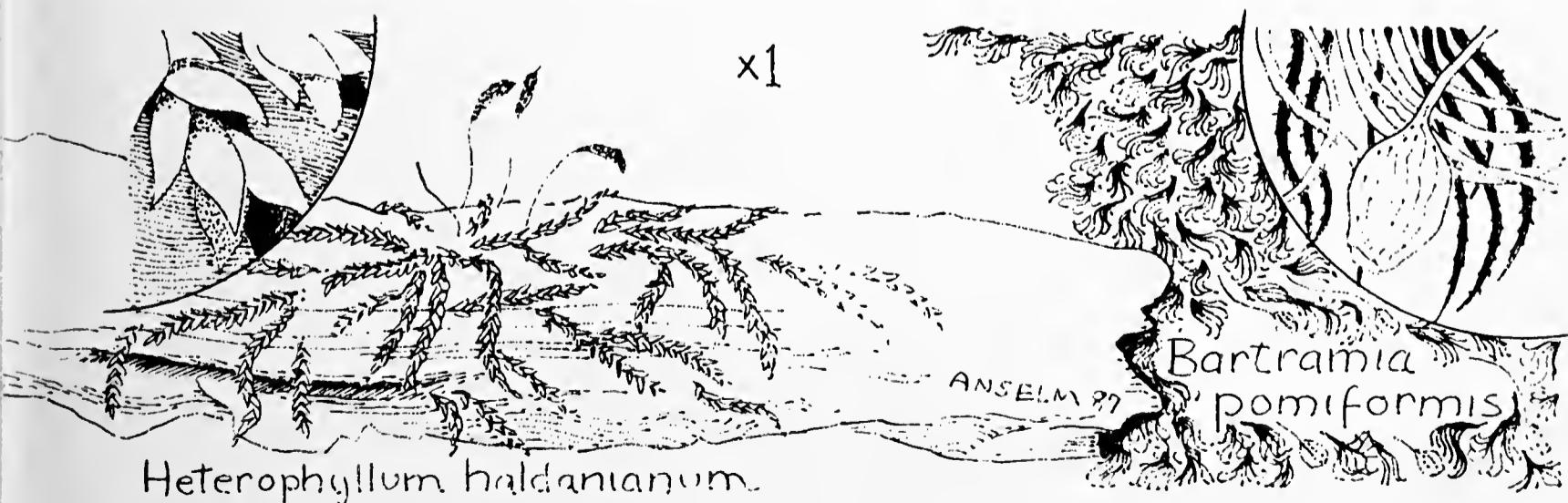
At the top of the sporophyte is a capsule, within which haploid spores are produced. These spores are released, carried away by the wind, and germinate to grow into the typical gametophyte, once again moss as we know it.

As the sporophyte of a moss matures, it is no longer capable of photosynthesis and the capsule fades from green to red, yellow, or brown.

The internal organization of the capsule can be quite intricate and, indeed, quite beautiful. Most mosses have a cap, called an operculum. It comes off at maturity, revealing a ring of deeply divided teeth known as peristome teeth. Viewed through a microscope, these teeth can be quite striking and are one of the most important taxonomic characters in identifying difficult species.

Peristome teeth regulate dispersal of spores from the capsule. The teeth contract in high humidity, and open in dry conditions. Dry, windy conditions are best for spore dispersal over long distances.

Movement of the teeth can be observed in the field with nothing more than a drinking straw, a good hand lens, and a willing partner. On a dry day in the fall or early winter, look for a clump of moss with dry capsules and exposed peristome teeth. Have your partner blow gently through the straw onto a



capsule while you watch the reaction of the teeth with a hand lens.

The same diversity of habitat that gives Georgia a great diversity of vascular plants—mountains, piedmont, coastal plain, and rivers that drain across all three, limestone escarpments, granite outcrops, swamps, barrier islands, sand hills—contributes to a good diversity of mosses.

Mosses are especially well-adapted as colonizers of microhabitats where few other plants, if any, will grow. The dark patches of *Grimmia* on granite outcrops, in extremely exposed areas, offer an example.

Lewis Anderson, the premier bryologist of the Southeast, has cited 434 species of mosses in the southern Appalachians, with 5 percent of them endemic to the region. Georgia probably has approximately 300 species, but a comprehensive study of the mosses of the state is not available. It is sorely needed.

Studying mosses is not an easy task, especially for the amateur. Only a handful are readily identifiable in the field; the rest require microscopic study.

Among the more familiar is *Polytrichum commune*, the hairy-cap moss of botany textbooks. It is tall and robust, often reaching heights of a foot or more. Certainly it is the tallest moss in Georgia.

Polytrichum is a member of the Polytrichaceae family, one of three moss families that form depressions at the top of the stems of male plants. These “splash cups” give them a sexual advantage: Raindrops hit the cups and splash sperm out onto the female plants. (The other two families are Mniaceae and Bartramiaceae.)

Another moss common in Georgia, *Atrichum angustatum*, exhibits splash cups. I have heard it called star moss, presumably because of the arrangement of the leaves near the tips of the upright stems. It is found on granite outcrops and is often on disturbed sites. Look for it especially where the roots of fallen

trees have left mounds of dirt.

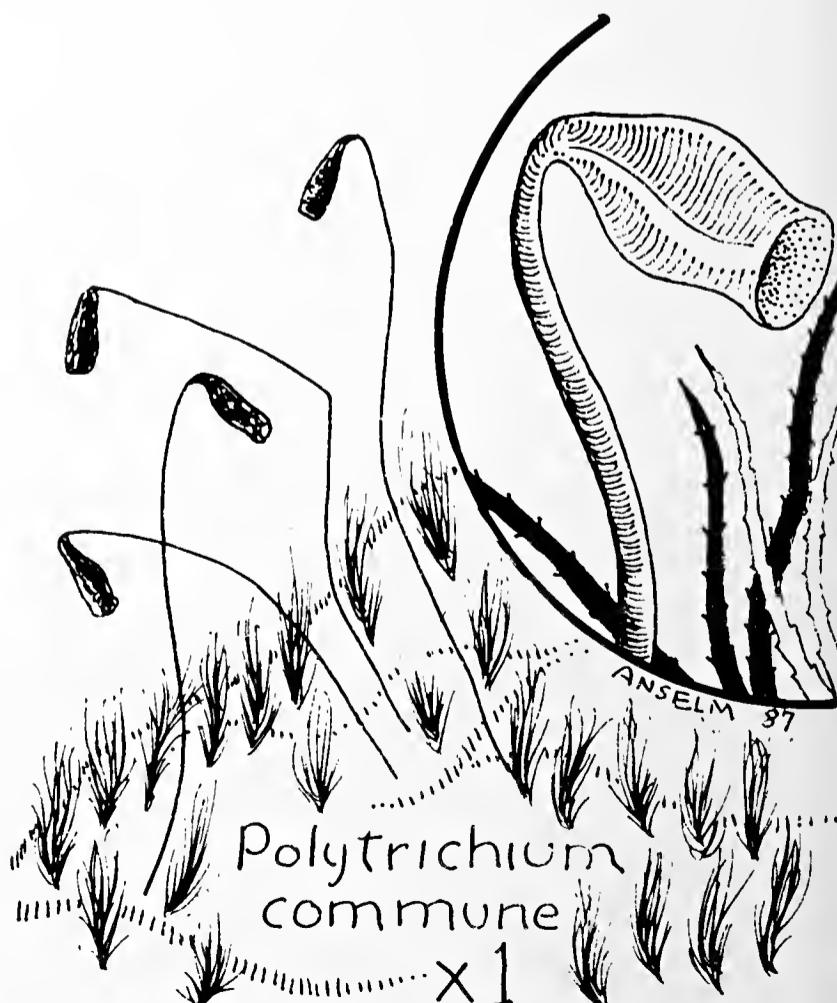
Certainly the most important commercial moss is *Sphagnum*, or peat moss. *Sphagnum* is used as a soil conditioner and planting medium, and in the past was used as a bandage material because of its sterile nature and as a packing material for explosives.

There are several species of sphagnum, all found in wet situations. They sometimes form extensive mats in low, moist areas that are not subject to long dry periods.

Perhaps the easiest moss to recognize in Georgia is *Thuidium delicatulum*, the delicate feather moss, or fern moss. It resembles a tiny, creeping fern and is somewhat feathery in appearance. Occasionally it covers huge areas, especially in the mountains, and often is found covering decaying logs.

Sometimes fern moss is collected for use in crafts, and I have seen it in use in shopping malls as a decorative soil cover for large potted plants. (Try botanizing a mall sometime. You'll be surprised!)

Some mosses hard to recognize as individual plants may be easy to identify by their habit en masse. *Leucobryum albidum*, the white moss, forms com-



pact white-greenish clumps that resemble pincushions. It is common along woodland trails and on cut banks.

Specificity of habitat may aid in identification of some other hard-to-recognize species. Some mosses prefer the trunks of trees; some are found even on specific species of trees. One, *Anacamptodon splachnoides*, likes knotholes; it grows along their edges. It also grows in wet fissures and crotches of trees.

Leucodon julaceus is a tree-growing moss common in the South. In old pecan groves, it is the dominant moss clinging to the tree bark. *Julaceus* means cylindrical, and the leaves of this moss are so tightly pressed to the stem when dry that they look like catkins. Put a drop of water on the stem and it fuzzes out, producing an amazing transformation.

Some mosses are aquatic or partially aquatic. *Brachelyma subulatum* almost always is found near the water line on the trunks of black gum and bald cypress. *Fontinalis* is a common moss of fast-flowing streams. *Amblystegium* is a genus of aquatic or semiaquatic mosses often found in swamps.

Bryophytes are the "other half" of the plant kingdom, and little-known, but fascinating in their own right. Next time out, take a hand lens and some native curiosity and look just a little lower than the wildflowers.

FOR FURTHER READING

Ruth S. Breen. 1963. Mosses of Florida: an illustrated manual. University of Florida Press. Helpful in Georgia as well as Florida.

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Addenda

An additional population of the persistent trillium, *Trillium persistens*, that is believed to double the number of plants known heretofore has been located in Tallulah Gorge, according to a report in the Anderson (South Carolina) Independent.

Chick Gaddy, a Walhalla, South Carolina, biogeographer, found the rare trillium in the course of a flora and fauna survey of the gorge. The persistent trillium is on the federal list of endangered plant



species. (See "The Persistent Botanist" by Miriam Talmadge, Tipularia, May 1987.)

Gaddy especially hopes to find the false rock pimpernel in Tallulah Gorge. It hasn't been seen there since 1898, he says.

The rarest rock pimpernel listed in "Atlas of the Vascular Flora of Georgia," Georgia Botanical Society, 1984, is *Lindernia saxicola* M. A. Curtis, which is shown in three counties in the northeast corner of the state—Rabun, Towns, and Habersham.

"Manual of the Vascular Flora of the Carolinas," University of North Carolina Press, 1968, says of *L. saxicola* that it is found on rocks "in rapid mountain streams" and is known in Georgia "only from the type locality in the Hiwassee River and from Tallulah Falls."

Gaddy's survey is being made for Georgia Power Company in connection with its application to the Federal Energy Regulatory Commission for relicensing of its hydroelectric plants in the Tallulah watershed.

A running dispute about the discovery date of *Shortia galacifolia*, the Oconee bell, may flare anew. (See "Shortia: Solving One Mystery" by Steven M. Jones, Tipularia, May 1987). A new book about Andre Michaux, the discoverer, by Henry Savage Jr. and Elizabeth J. Savage, goes for a December 1788 date rather than the now widely accepted June 1787 date.

Impressive guide to seaside plants

The Smithsonian Guide to Seaside Plants of the Gulf and Atlantic Coasts from Louisiana to Massachusetts, Exclusive of Lower Peninsular Florida by Wilbur H. Duncan and Marion B. Duncan. 1987. Smithsonian Institution Press, Washington, D.C. 409 pages. Hardcover, \$45; paperback, \$29.95.

This book with its impressive title (abbreviated here as "Seaside Plants") is equally impressive in its contents. It includes 949 species of seed plants, with excellent color photographs supplied for 588 of these. Fine-quality line drawings by Rose F. McAuliffe are extremely helpful and nicely supplement the photographs.

For all species, there are descriptions containing information that will facilitate correct identifications. The information includes physical descriptions, habitat preferences, general range, and the flowering times.

The species are arranged into general categories such as woody vs. herbaceous, monocots vs. dicots, and flowers with or without petals. Within each group, plants are arranged in a traditional phylogenetic sequence indicating relationship, rather than alphabetically.

Both amateurs and professionals will find this book useful. Most genera may be identified either by examining the photographs and drawings or by using a series of keys provided at the beginning of the book.

I was especially impressed by the completeness of the text, the well-organized plan of presentation, and the versatility of the book. Each user will find something different.

The casual beachcomber or coastal traveler will find a very compact and attractive book that can be used to identify plants seen on the occasional pleasure trip to the seashore.

The more advanced student or teacher will find in this book a professional text that could be used in a course on coastal flora or coastal ecology. There are sections typically found in texts, such as the glossary and the illustrations of morphological terms used in the book.

I found a very few problems in the text. On page 24 there is a comment that "the upper 6 miles (10 km) at the north end of Assateague Island are completely blighted

by crowded housing for summer use." That is totally inaccurate, as this area is all part of the National Seashore and has no such housing.

"Smilacaceae" is consistently misspelled as "Smilicaceae" throughout the text (pages 189, 348, 406). *Amaranthus pumilus* Rafinesque, on page 238, is said to be occasional. This species is actually being considered for federal listing as an endangered

Book Report

species. In several states it is thought to be now extinct, as in Maryland, where it has not been seen for over 15 years.

Other problems are those of an esoteric taxonomic nature, such as use of the genera *Sarcocornia* instead of *Salicornia*, *Daubentonnia* instead of *Sesbania*, *Cassia* instead of *Senna* or *Chamaecrista*, and *Leucanthemum* instead of *Chrysanthemum*.

But I was pleased to see the use of some other genera such as *Phyla*, *Aronia*, *Euthamia*, *Bignonia*, *Toxicodendron*, *Schizachyrium*, *Conyza*, *Triodanis*, and *Acnida*.

Unfortunately, a few typographical errors did creep in, such as "Nymoides" (for "Nymphoides") on page 117 and "Cherophyllum" (for "Chaerophyllum") on page 45. Also, in my copy of the book, several of the photographs on pages 220-221 were badly reproduced.

These few problems are far outweighed by the otherwise flawless nature of the book.

"Seaside Plants" was written after intensive (and no doubt enjoyable) research that took the authors from Canada to Mexico. The first-hand knowledge of the authors and the beautiful photographs are the result. Much of the information could be gleaned only with difficulty from existing manuals and floras. I highly commend the book to anyone interested in coastal plants.

I hope that this book will inspire others to undertake similar studies of equally high quality in areas such as the Florida peninsula, Caribbean, southern Gulf, and Pacific coasts.—*Steven R. Hill, Ph.D., Department of Biological Sciences, Clemson University, Clemson, SC 29634-1903.*

The mystery of Wolf Creek

It took some coast-to-coast sleuthing to solve the case of a strange plant found growing wild in Rabun County

By Burns Gibbs and Hazel Howland

Illustrated by Bill Close

Burns Gibbs begins the story: According to all the laws of probability, it shouldn't have been there, but it *was*, and subsequent information has enabled us to establish some well-based inferences as to how it got there.

On a mid-September afternoon in 1971, naturalist Marie Mellinger of Tiger, Georgia; Dr. Warren Gignilliat, retired professor of English at Macon's Wesleyan College; and my wife, Ruth, and I, who live in Clayton, were looking for dwarf ginseng near the Wolf Creek Baptist Church in southeastern Rabun County, Georgia.

We did not find the dwarf ginseng, but came upon something which has attracted much more attention since it was found growing there: the Japanese paper plant, *Edgeworthia papyrifera*, used in Japan for the manufacture of a very high-grade paper.

The area around the church and from there to Lake Chattooga on the Georgia-South Carolina line is no longer populated except by beavers and other denizens of the wild, as the land has become part of the Chattahoochee National Forest. The church is still in use and still maintains its old cemetery. The fact that former residents sold their land to the U.S. Forest Service and moved away, however, at least partially accounts for why the paper plant could grow nearby for years and remain unnoticed.

That afternoon, as we looked for the dwarf ginseng near the creek and gathered some ripened wildflower seeds along the way, three of us would

have passed by without a second glance at the bush that attracted Marie's attention. She knew instantly that it was a plant no botanist would have expected to find there.

Marie sent specimen branches to the University of Georgia, but no one there was able to make positive identification. Then it went to Arnold Arboretum and Harvard University scientists, who eventually established our mystery plant as *Edgeworthia papyrifera*.

There still was the question as to how it came to be growing in this



rather secluded area in Rabun County.

Its uppermost location was found to be an abandoned house site near a small tributary of Wolf Creek. Subsequent investigation showed that the paper plant had become naturalized from that point all the way downstream to Wolf Creek's juncture with Lake Chattooga.

That, in itself, was a considerable journey. But there was more to the plant's journey, much more. We had some work to do.—*Burns Gibbs.*

Hazel Howland takes it from here: Close examination of the plant that attracted Marie's attention on the day of discovery—September 15, 1971—had revealed that its five-foot stems had soft, dark green whorls of entire leaves. Each stem forked near the top, and each branch held silky, silvery, flat flower buds. The stems were covered with pronounced, crescent-shaped leaf and bundle scars. The stems were tough and pliable and, when cut, exuded an unpleasant odor.

Finding this unfamiliar shrub in the wild was the botanical equivalent of winning a million-dollar lottery. But the detective work of finding out what it was and how it got there lay ahead.

Marie corresponded with botanists expert in flora of the eastern United States. As the case unfolded, frequent visits were made to the site to gather information and the specimens requested by the botanical world.

Richard Howard of the Arnold Arboretum in Cambridge, Massachusetts, provided the initial identification. He noted in a letter to Marie on December 30, 1971, that the plant, like the native leatherwood shrub, *Dirca palustris*, was a member of the Thymelaeaceae family.

To Dr. Howard, the plant was *Edgeworthia chrysantha* Lindley, but he mentioned further that it had also been called *Edgeworthia papyrifera*. The difference between the two species was the size of the flower cluster.

Positive identification as *papyrifera* came later from two Harvard scientists.

There was great excitement on February 26, 1972, when the Wolf Creek plants were seen blooming on branches still bare of leaves. Honeybees were busy visiting the vivid yellow, daphne-like flowers. A lovely fragrance exuded by the flowers filled the air. On later visits, there were small, bright green, ovate fruits.

Marie, Gene Cline, and Joyce Swanberg found the former house site upstream from the church on May 27, 1972. Only chimney rubble and wall foundations were left of the house, but narcissus and daffodils were blooming profusely on terraced flower beds.

There also were extensive plantings of crape myrtle and, most significant of all, several large *Edgeworthia* shrubs, which possibly were the parent plants.

"We were able to find people still living in Rabun County who had formerly lived near the church," Burns Gibbs said. "They told us that the site was the location of the summer home of a family named Haynes or Haines or Haymes from Atlanta."

Marie's correspondence began to uncover the trail of the paper plant from Japan. George Avery of the Fairchild Tropical Garden wrote her that in the early 1900s David Fairchild had become interested in *Mitsumata*, as the plant is called in Japanese.

Fairchild had collected the plant in Japan in 1902. It was first grown in this country at the U.S. Plant Introduction Station in Chico, California. Later it was sent to Atlanta for trial.

Dr. Fairchild wrote in his book "The World Was My Garden," published in 1938:

"When we distributed the Japanese paper plant, *Mitsumata*, from the Chico Garden in California, some plants were sent to W. T. Ashford of Atlanta, Georgia. The *Mitsumata* grew beautifully on the hillside along Peach

Tree Drive (*sic*)....The test of the Atlanta plantation was a qualitative test only, that is, it proved that the trees would grow there, while the quantitative test to prove whether Mitsumata paper could be produced at a profit had yet to be made. It never was." Ashford operated a nursery.

Avery reported that a road-widening project around 1926 wiped out the scientific planting along Peachtree, but that shrubs planted by an unknown gardener at a summer home in the mountains thrived.

That, in all probability, was the home upstream from Wolf Creek Baptist Church. *Edgeworthia papyrifera* had not come there on its own, but it had naturalized and traveled for many miles downstream without human help

and without even being noticed for half a century or longer.

In Japan, the paper plant is grown in the shade of alders, and it is found in their shade along Wolf Creek. Pink azalea, mountain laurel, red maple, beech, nanny-berry (*Viburnum prunifolium*), holly, greenbrier, climbing hydrangea, and clethra are among the plants that share its habitat.

A hike along Wolf Creek in late February or early March to see the paper plant in flower has become an annual rite for the Georgia Botanical Society. The weather may be miserable or bright, there may be few flowers or many, but the paper plant, either upstream or down, always rewards the pilgrims with the promise of spring to come.—*Hazel Howland*.

Taking it for granite

Continued from page 23

They reported in 1964 that they found depth of soil the major factor in determining which species will survive. As deeper soil accumulates, each group of plants is gradually replaced by another group requiring deeper soil and able to outcompete most of the earlier plants.

A different type of research deals with the evolution of new kinds of plants, whether by speciation, in which an isolated population of an old species gradually becomes adapted to slightly different environmental conditions, or by hybridization followed by chromosome doubling, making the new species fertile.

Murdy has studied examples of both types of evolution. He postulates in a 1966 report that two taxa of *Phacelia* endemic to granite outcrops, *P. maculata* and *P. dubia* var. *georgiana*, have evolved from typical *P. dubia*, which has a wide range in the Appalachians and to the north.

Clearly, these outcrops are a relatively unusual resource and are, at the same time, quite fragile as an ecosystem. As

we work to preserve our natural communities and resources, granite outcrops must be protected every bit as much as forests and wetlands.

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Research Report

From *Asclepias* to *Zephyranthes*

Edited by Harriett L. Whipple

Several Georgia botanists presented papers at the 50th anniversary meeting of the Association of Southeastern Biologists in Athens, Georgia, April 8-11, 1987. Abstracts of these papers appear in ASB Bulletin, volume 34, number 2, April 1987.

The papers:

Steven B. Broyles and Robert Wyatt, University of Georgia. Floral displays and reproduction in poke milkweed, *Asclepias exaltata* L.

Steven B. Broyles, Robert Wyatt, William M. Houghton, Mary Jo Godt, Suzanne Kolb, and Roger Laushman, University of Georgia. The breeding system of *Zephyranthes atamasco* (L.) Herbert.

Nancy C. Coile, University of Georgia. Scanning electron microscopy studies of *Ceanothus* seeds.

James W. Hardin, North Carolina State University, and Susan L. Sherman, University of Georgia. Foliar surface features of American elms (*Ulmus*).

David M. Hunt, University of Georgia. Delimitation of taxa within the *Quercus laurifolia/Q. hemisphaerica* complex.

Samuel B. Jones and Nancy C. Coile, University of Georgia. St. Catherines Island, Georgia: A profile of floristic diversity as it relates to barrier island formation and human activities.

Robert C. Kelly and R. R. Sharitz, University of Georgia Savannah River Ecology Laboratory. Settlement-era composition of floodplain and upland forests determined using colonial land surveys.

W. H. Murdy, M. E. B. Carter, and N. Wolff, Emory University. Regulation of the timing of pollen germination by the pistil in *Talinum mengesii*.

John Shepherd, Mercer University. Nectar thievery and reproduction in the alpine wallflower, *Erysimum nivale*.

Susan L. Sherman, University of Georgia. Multivariate analyses in the genus *Ulmus* L. in eastern North America.

A poster session was presented by Susan Bratton, University of Georgia, on "Impacts

of experimental poaching on pink lady's slipper, *Cypripedium acaule*, and on common wood violet, *Viola papilionacea*."

Forum for herbarium curators and users: Space and fumigation problems in southeastern herbaria. Jim Massey, University of North Carolina-Chapel Hill; Nancy C. Coile, University of Georgia; Jim Matthews, University of North Carolina-Charlotte; and Andy Aulbach-Smith, University of South Carolina.

Mobile shelving installed in the University of Georgia herbarium has doubled storage space for the collection. The compactor system cost \$174,000, with \$114,000 provided by the National Science Foundation and the rest from university funds. If you are interested in visiting the herbarium, call 404-542-1823.

Brief notes on botanical research completed or underway and requests for information related to research will be considered for publication in *Tipularia*. Send to: Harriett L. Whipple, Research Report editor, Box 824, Milledgeville, Georgia 31061.

Book Report

Speaking of trees

The Trees Upon the Mountain by Marie Mellinger. Drawings by Rose Moorman. 1987. 70 pages. The Mountain, 841 Highway 106, Highlands, NC 28741. Softcover, \$4.95.

This book is Marie's best work yet. It is well-organized, and the descriptions of trees, shrubs, and vines are informative and entertaining.

Marie does not just give a description of the plant to help the nature lover identify it, but also highlights its past and present uses by man. Only a person with Marie's vast knowledge and love of plants could do such an easy-to-use book.

The illustrations by Rose Moorman are large and clear. They assist in identifying the plant properly and quickly.

The book contains 67 species, with a table of contents listing each by common and scientific names.

Having the common trees, shrubs, and vines of the mountains in one book is unique and makes it a must to own for all who love identifying plant life in the mountains.—*Louis W. Schweizer*.



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Byliners

Artists

Anselm Atkins of Decatur, Georgia, is a stained glass artist and a former cartoonist.

Margery Borom of Lithonia, Georgia, knows a world about insects from her 20 years with the Centers for Disease Control in Atlanta.

Bill Close, of Decatur, Georgia, has contributed drawings to every issue of *Tipularia*.

Mozelle Funderburk of Stone Mountain, Georgia, puts her considerable talent as an artist to work in three-dimensional media also. Husband David is a botanist.

Gregory A. Krakow, in a tradition begun by early botanists, is able to illustrate his own work. See why below.

Authors

Anselm Atkins is a man of many parts, better known in birding circles, perhaps, than among botany buffs. For more about him, see above.

Moonyean S. "Tee" Brower is associate professor of biology at Armstrong State College in Savannah, Georgia. With entomology as her secondary field, she has a particular interest in plant-insect interactions.

Elmer Butler, who lives in a (modern) log house near Clarkesville, Georgia, is an active environmentalist and conservationist.

Anna Belle Close of Decatur, Georgia, has a way with words in more ways than one. She is *Tipularia*'s principal proofreader—a volunteer, of course, like everyone who works on or contributes to the magazine.

Jerome Drown, before retiring and moving to the east Tennessee mountains near Gatlinburg, was a well-known and much-admired professional photographer in Atlanta.

David Emory, with years of teaching behind him, not only is well-schooled in botany, but also is a field botanist *par excellence*. He and wife Sally have a small lake (their own) on their place at Palmetto, Georgia, not too far from some rock outcrops.

Charlotte A. Ford is associate professor emerita of history at Georgia Southern College in Statesboro. She retired in 1986 and hopes to make Eliza Frances Andrews as

well-known today as she was in her lifetime.

Burns Gibbs is a retired Presbyterian minister living in Clayton, Georgia.

Steven R. Hill is curator of the herbarium at Clemson University, in South Carolina, where he arrived recently after eight years of herbarium curation, teaching, and research at the University of Maryland. He has collected and studied extensively in Brazil, Mexico, Central America, and the Caribbean area and throughout the United States. He recently published a study of the Assateague Island barrier island system in Maryland and Virginia.

Hazel Howland of Cary, North Carolina, a planner of customer publications at IBM, has pursued her interest in botany in several states, including Georgia.

Gregory A. Krakow, now working on a master's degree at the University of Georgia, graduated from Mercer University in 1972 with a B.A. in art.

Hal Massie, who has a B.S.A. in botany from the University of Georgia, has done taxonomic studies on the mosses of the Florida Gulf coast and the Pine Mountain region of west-central Georgia. He has conducted environmental education programs for Sandy Creek Nature Center in Athens and Callaway Gardens. He lives at Marietta, Georgia.

Marie Mellinger, versatile naturalist and writer, has edited the correspondence between Roland M. Harper and J. K. Small. Her home is uphill from Tiger, Georgia.

Rebecca Nunan has a B.A. in zoology from Agnes Scott College, an M.S. in biology from the University of Michigan, and a Master of Library Science from Emory University. She has worked in the herbarium and the medical library at Emory and in the University of Michigan Botanical Station library.

Thomas S. Patrick, botanist with the Natural Heritage Inventory, Georgia Department of Natural Resources, is, among other things, an expert on trilliums.

Louis W. Schweizer lives in the city (Atlanta) and in the country (Rabun County, Georgia), where Marie Mellinger is one of his neighbors.

Panther Creek's wonderland trail

By Elmer Butler

"Out of the hills of Habersham" begins a famous poem, Sidney Lanier's "Song of the Chattahoochee." Unlike the Chattahoochee River, which wanders nearly the entire length of Georgia, Panther Creek finds its way almost entirely within Habersham County, Georgia, before it reaches the Tugaloo River.

Soon after leaving the upper slopes of Stony Mountain, Panther Creek turns southeasterly near Bear Gap, gaining size and speed until it crosses U.S. Highway 441 at the public Recreation Area north of Turnerville.

Here the creek joins with a blue-blazed trail leading into a world that, according to scientists, has seen little change during the past 25 million years.

Mountain laurel and rhododendron are dense under the oaks, poplars, hickories, and maples. One is soon aware of being in a gorge much higher than the treetops.

Sounds of cascades and falls sing to the forest as the creek, moving along, claims its share of the glory. For most of its length, in rich soil along the sides, *Polygala paucifolia*, the gay-wings, commands the attention usually reserved for orchids, though it is not an orchid. The profusion of the tiny gay-wings is truly an early spring highlight.

Further down and more hidden away are the north-facing coves of Panther Creek, containing other rare species. In later April can be seen *Trillium discolor* with its pale yellow petals, blue cohosh, doll's-eye, and white nodding trillium. Both glade ferns and fragile ferns grow on the flood plain of a small stream underneath an occasional silverbell tree or a yellowwood.

Trillium persistens, which is on the list of endangered plants in Georgia, can be seen along the gorge slopes past the coves. In early April it begins to show white blooms, which later change to pink.

The cove area has drawn a number of out-of-state botanists, who have made comparisons and commented as to the striking resemblance of many cove species to species growing in eastern Asia. Among them are umbrella leaf, blue cohosh, dogwoods, May-apples, and ginseng.

Under the present Management Plan for the Chattahoochee and Oconee National

Site-seeing

Forests, nearly 600 acres of Panther Creek are protected below its falls under Management Area 13, which "includes lands to be designated as Natural Areas (Botanical/Zoological)."

An upcoming threat will occur when the state's Development Highway Program continues its four-lane project north of Hollywood, Georgia. It is hoped that in crossing Panther Creek the road-wideners will avoid a small patch of upright ground pine a few hundred feet from the Recreation Area.

Gaudy, but nice

By Anna Belle Close

A luncheon date was cancelled, a camera club meeting was skipped, and we joined a Bot Soc field trip to Panther Creek.

It was two and a half weeks into April, and a grand array of familiar wildflowers bloomed along the trail. Suddenly, someone with sharp eyes spied gay-wings, *Polygala paucifolia*, well off the path and down a hillside.

All of us were about to clamber down for a close look when there was another shout: "No need for that! There's plenty farther along."

How right that proved to be. Gay-wings grew in profuse clusters on both sides of the path for at least a quarter of a mile.

It was a sight I could hardly believe. The color was so rich. What was it? Pinkish purple? Fuchsia? Vermillion? John Burroughs has likened gay-wings to a flock of rose-purple butterflies.

I bent close so I could examine it closely: two wings, one on each side of a trumpet-like corolla that ended in a delicately whiskered fringe.

There is another way into and out of Panther Creek gorge, but the way we went in was all downhill and the uphill way out was even steeper.

The day's agonies had their reward, however, in an everlasting memory of the fringed polygala, gaudy, yet delicate, gone rampant along the singing stream.